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Rawls-Meehan

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(54) **LEG ASSEMBLY FOR A SUPPORT FRAME**

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Related U.S. Application Data

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(52) **U.S. Cl.**
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(Continued)

(58) **Field of Classification Search**
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A47C 19/024; A47C 19/045; A47C 19/04; A47B 91/02; A47B 91/022; A47B 91/024; A47B 91/026; A47B 91/028; A47B 91/16
USPC 5/310, 285, 279.1, 200.1, 201, 202, 5/114, 509.1, 658, 660; 248/188.2, 188.4
See application file for complete search history.

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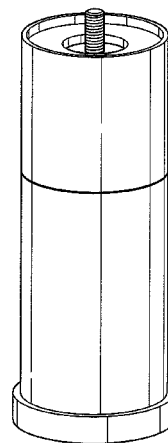
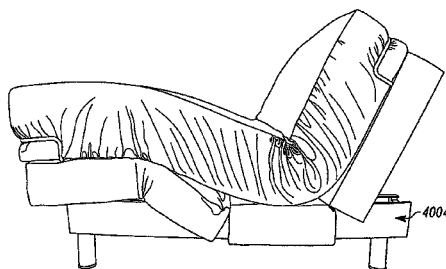
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(57) **ABSTRACT**

A support system includes a support frame and at least one modular leg assembly mounted to and supporting the support frame. The leg assembly includes a first leg member and a second leg member. The second leg member has a top-to-bottom length that is greater than the top-to-bottom length of the first leg member. The first and second leg members are connected individually or in combination to the support frame such that at least three leg heights are selectably provided. The leg members may each have a threaded connecting element extending therefrom for connecting the leg member to another leg member or to the support frame. The support system may be a mattress support frame. The at least one modular leg assembly may be a plurality of modular leg assemblies.

16 Claims, 67 Drawing Sheets



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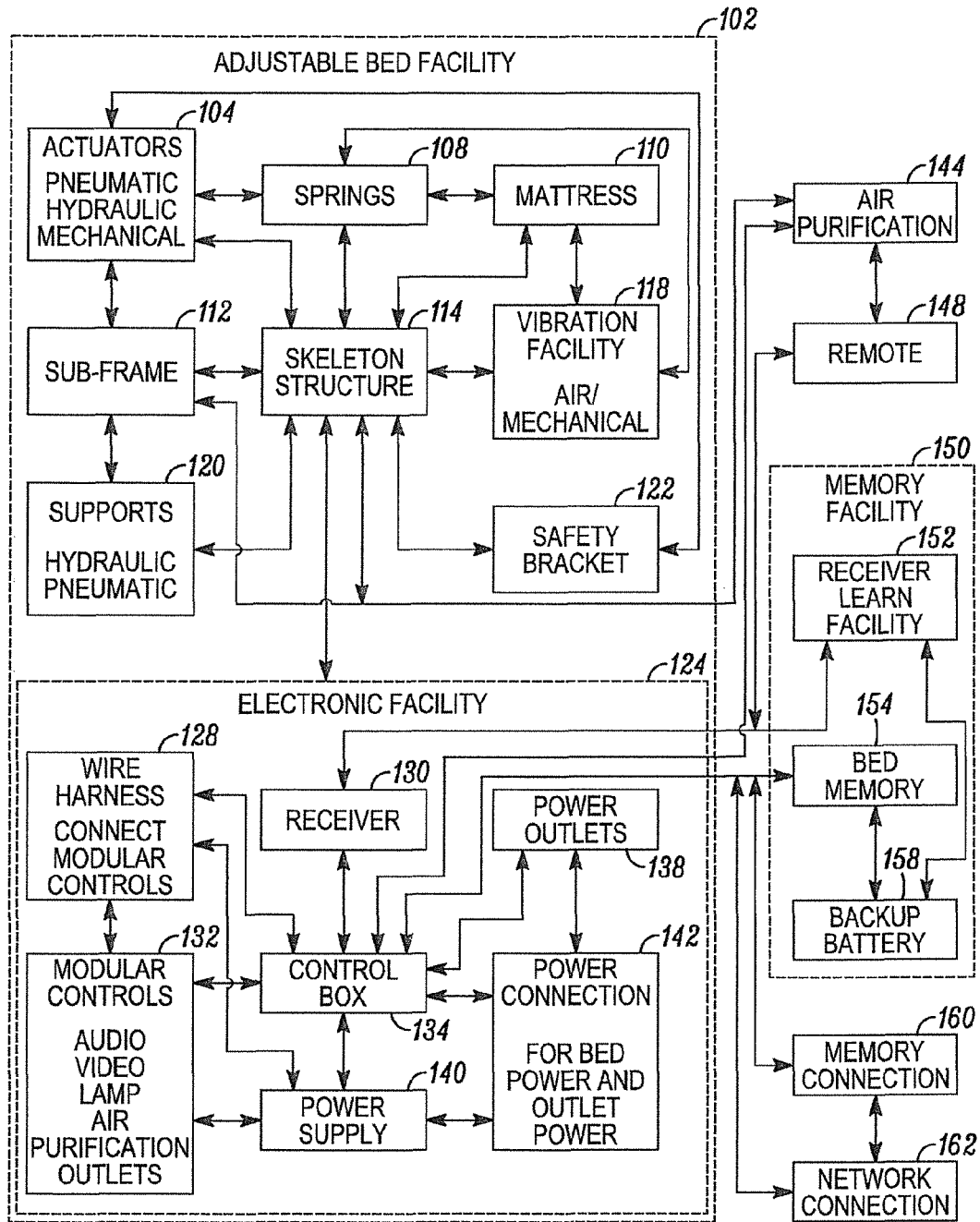


FIG. 1

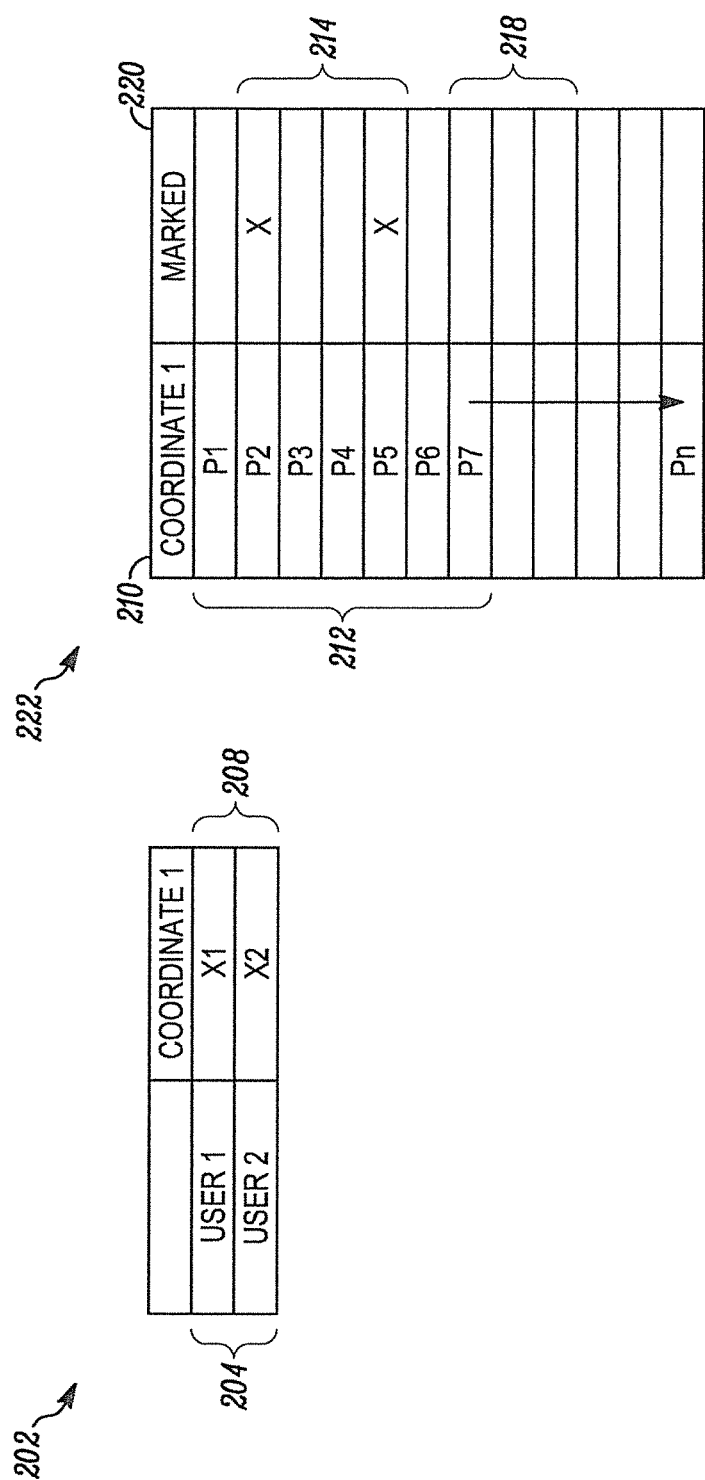


FIG. 2

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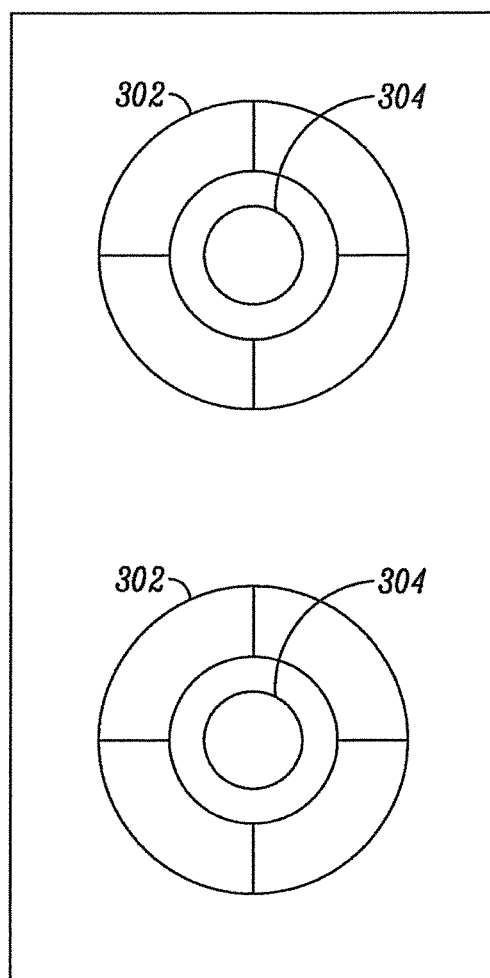


FIG. 3

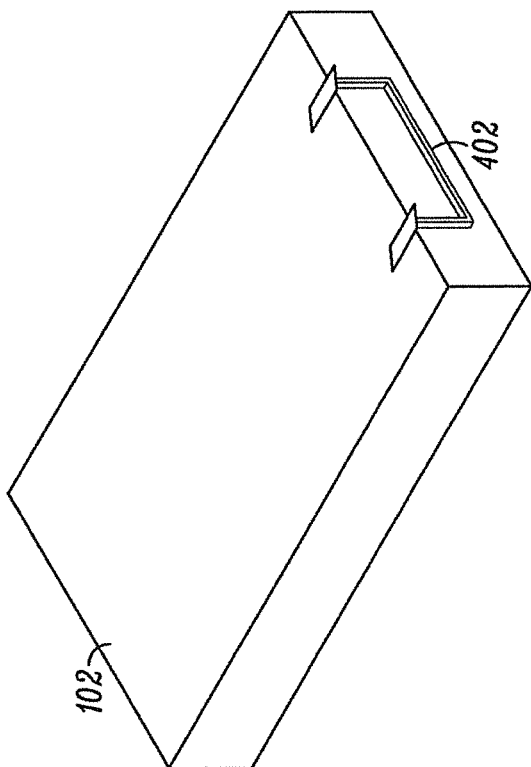


FIG. 4A

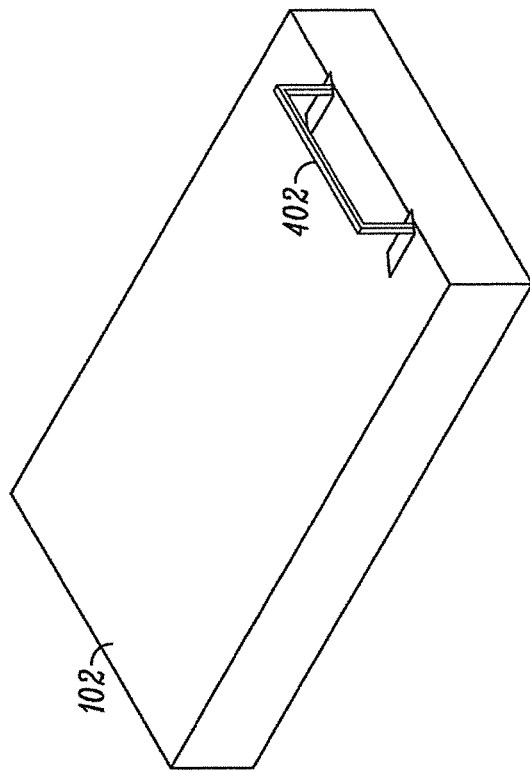


FIG. 4B

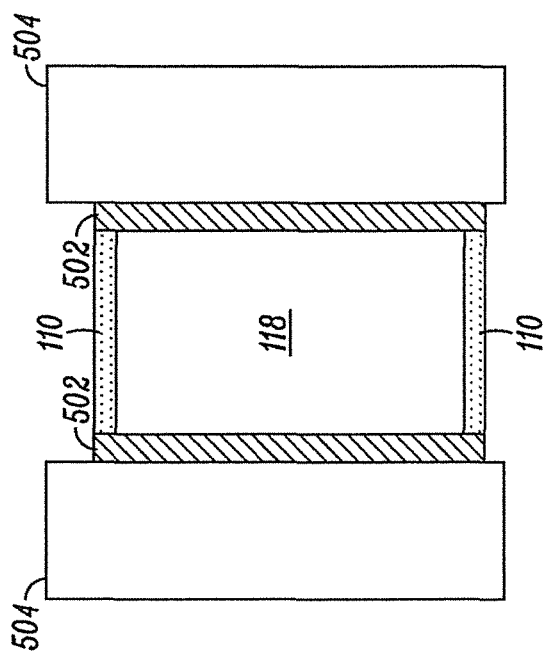


FIG. 5A

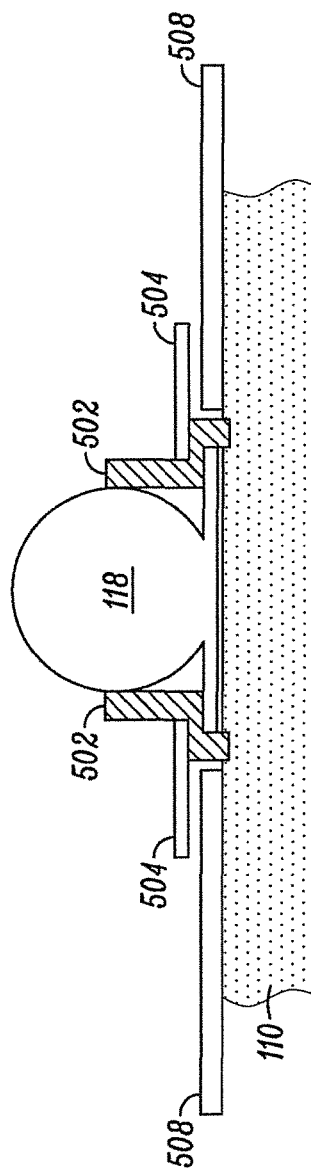
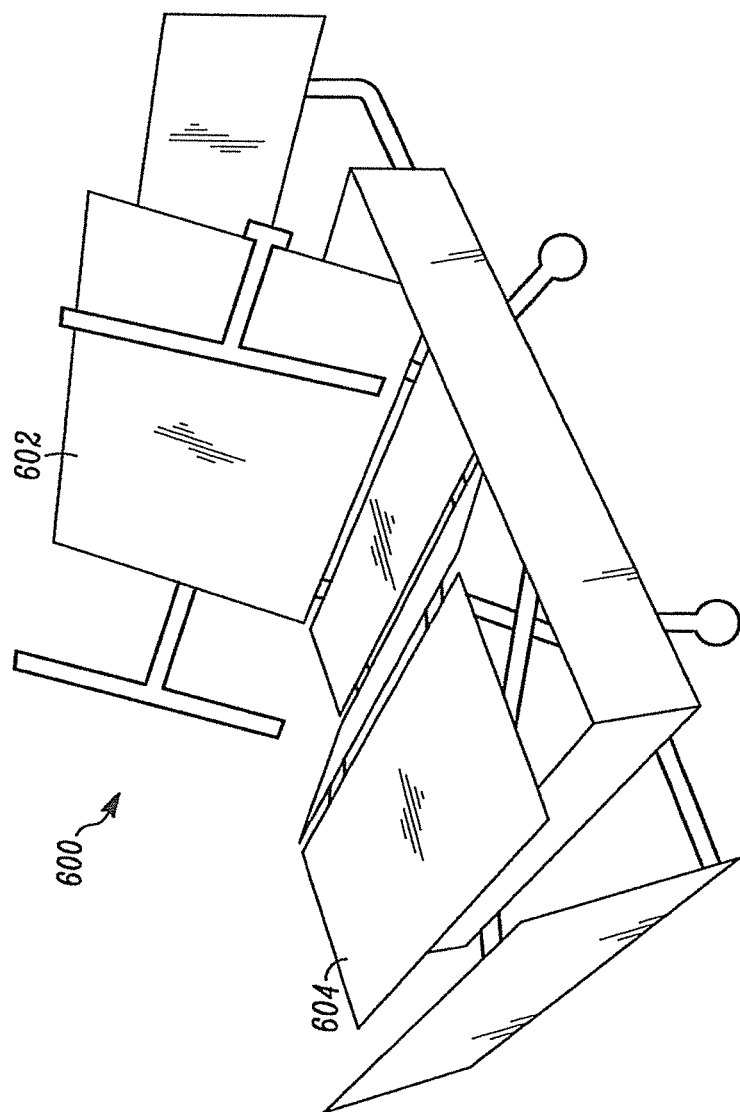


FIG. 5B



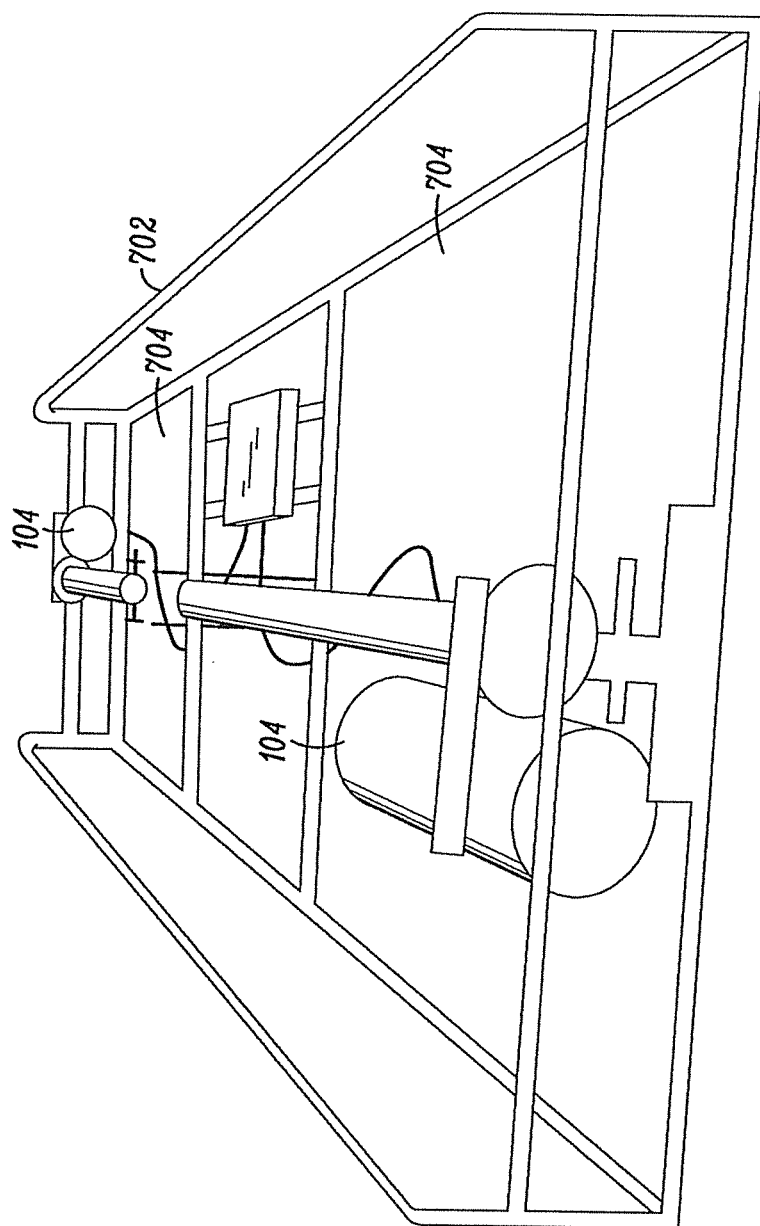


FIG. 7

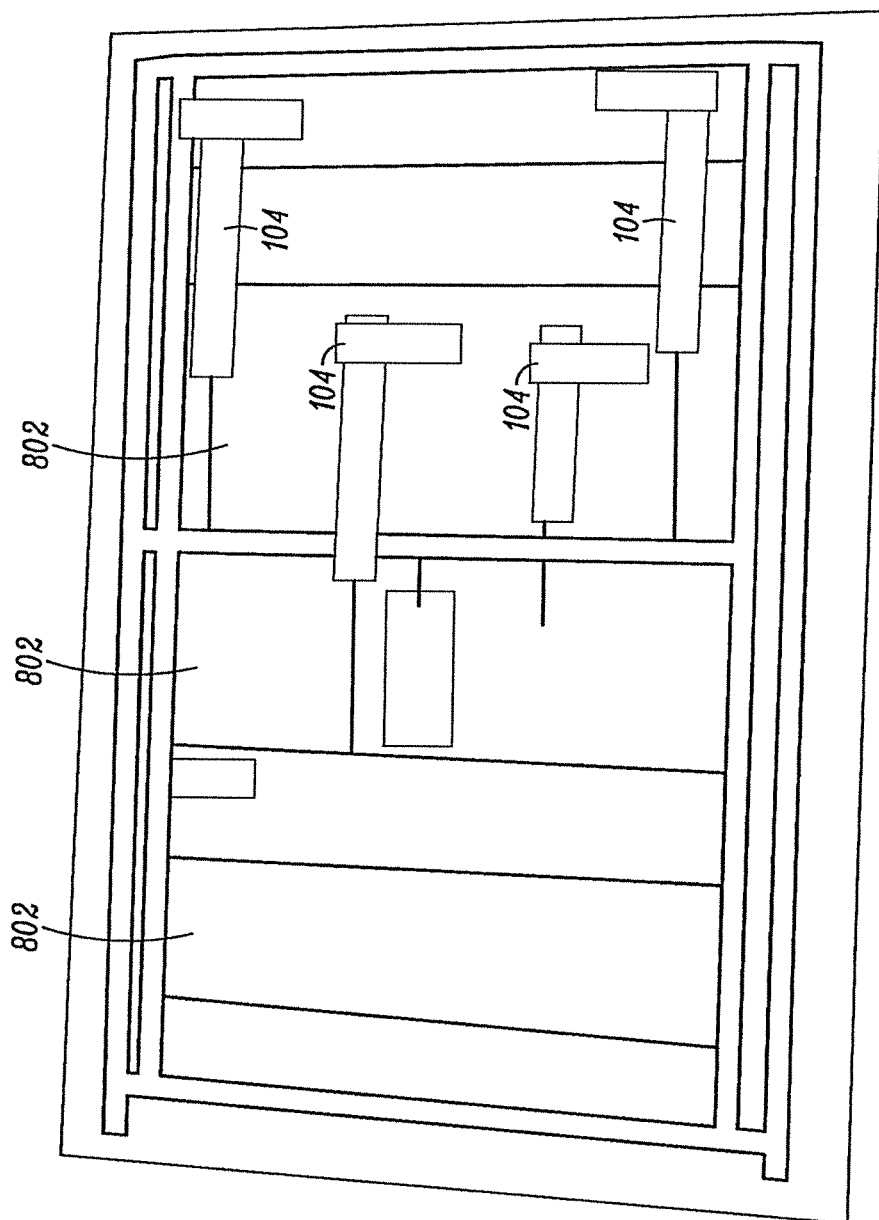


FIG. 8

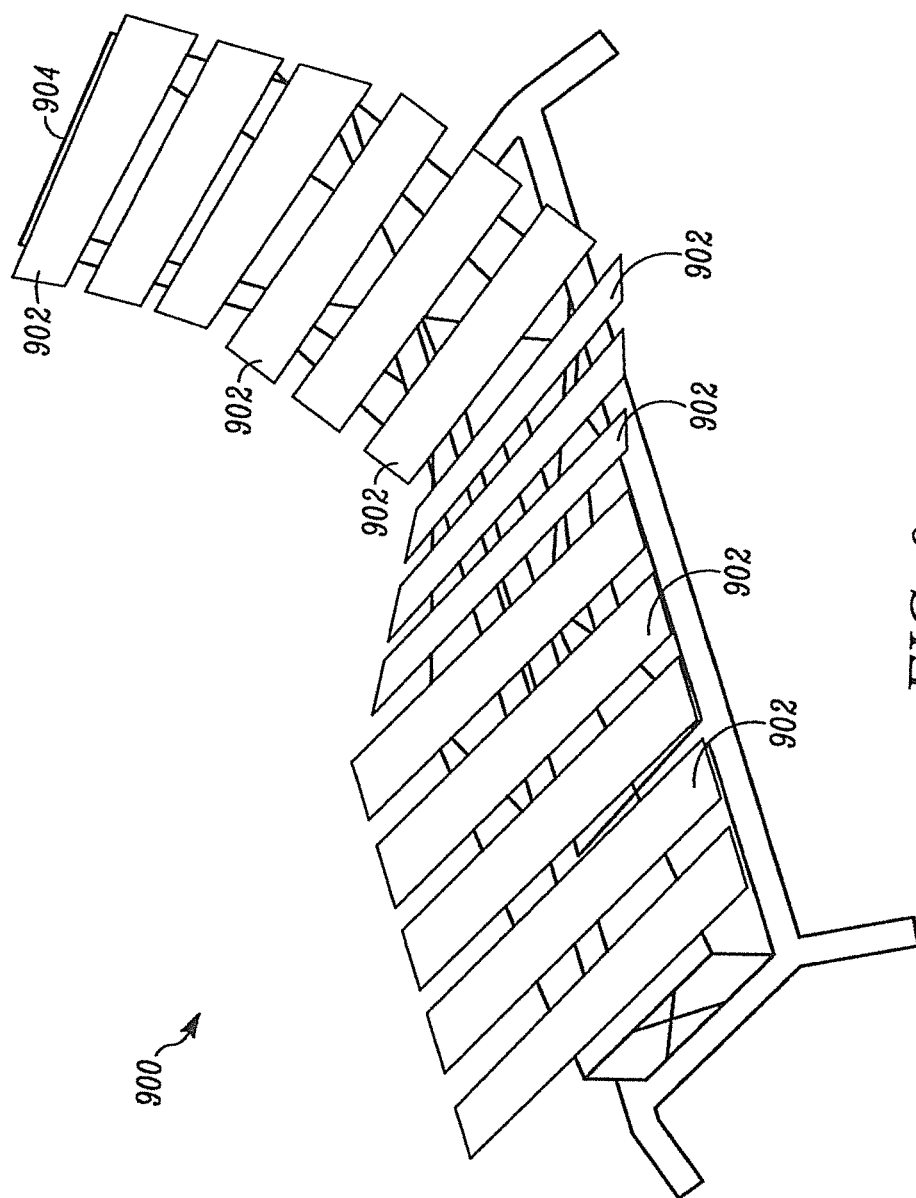


FIG. 9

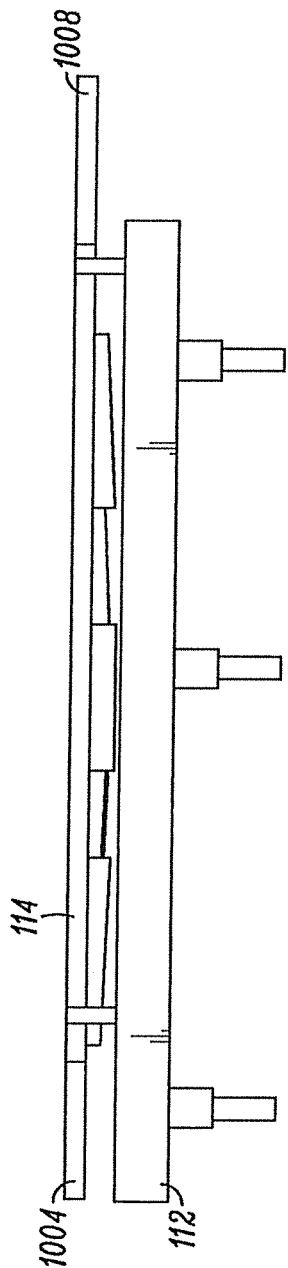


FIG. 10A

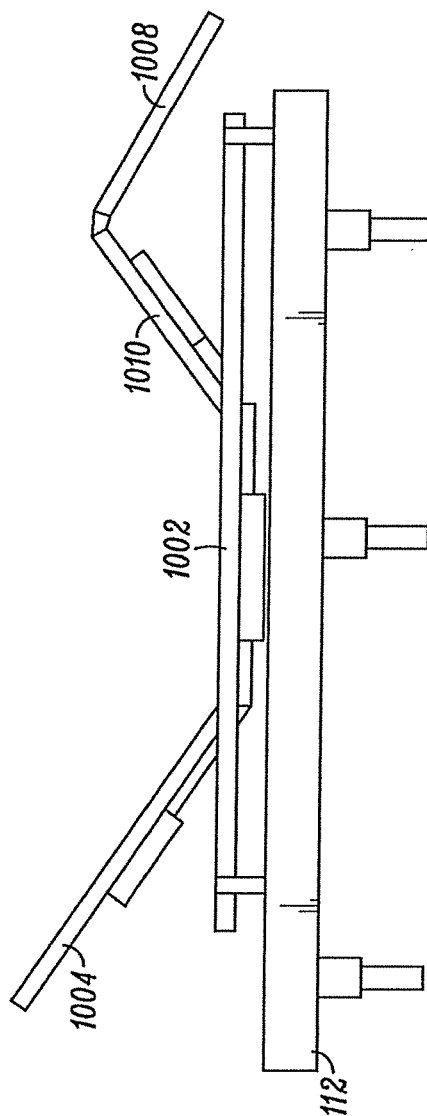


FIG. 10B

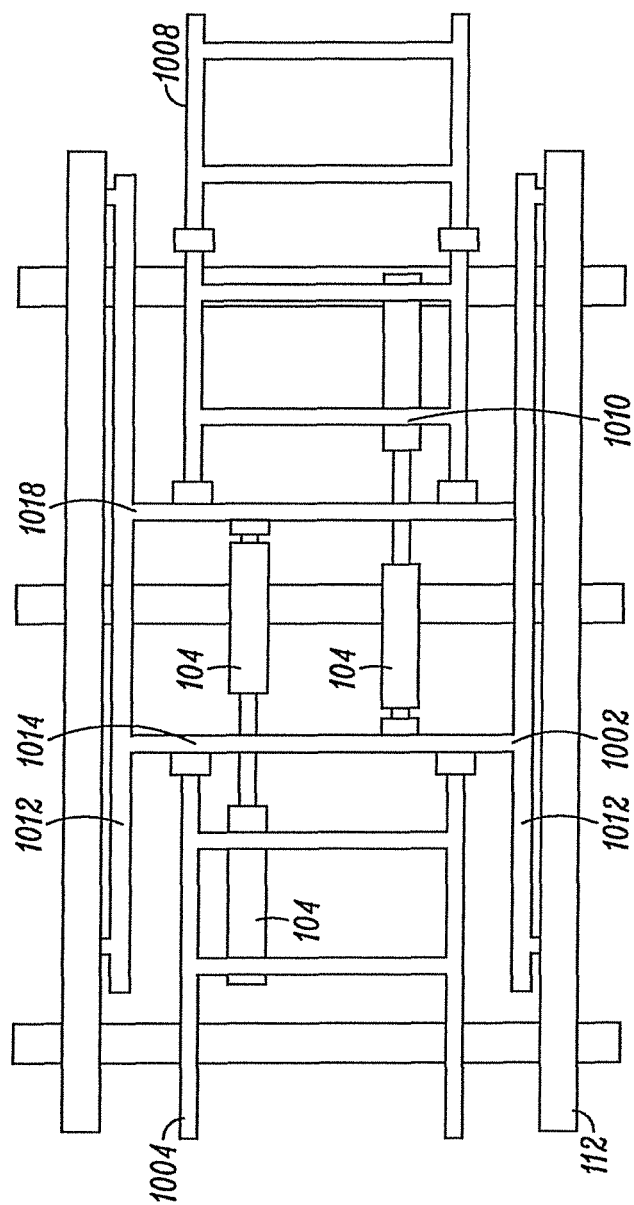


FIG. 10C

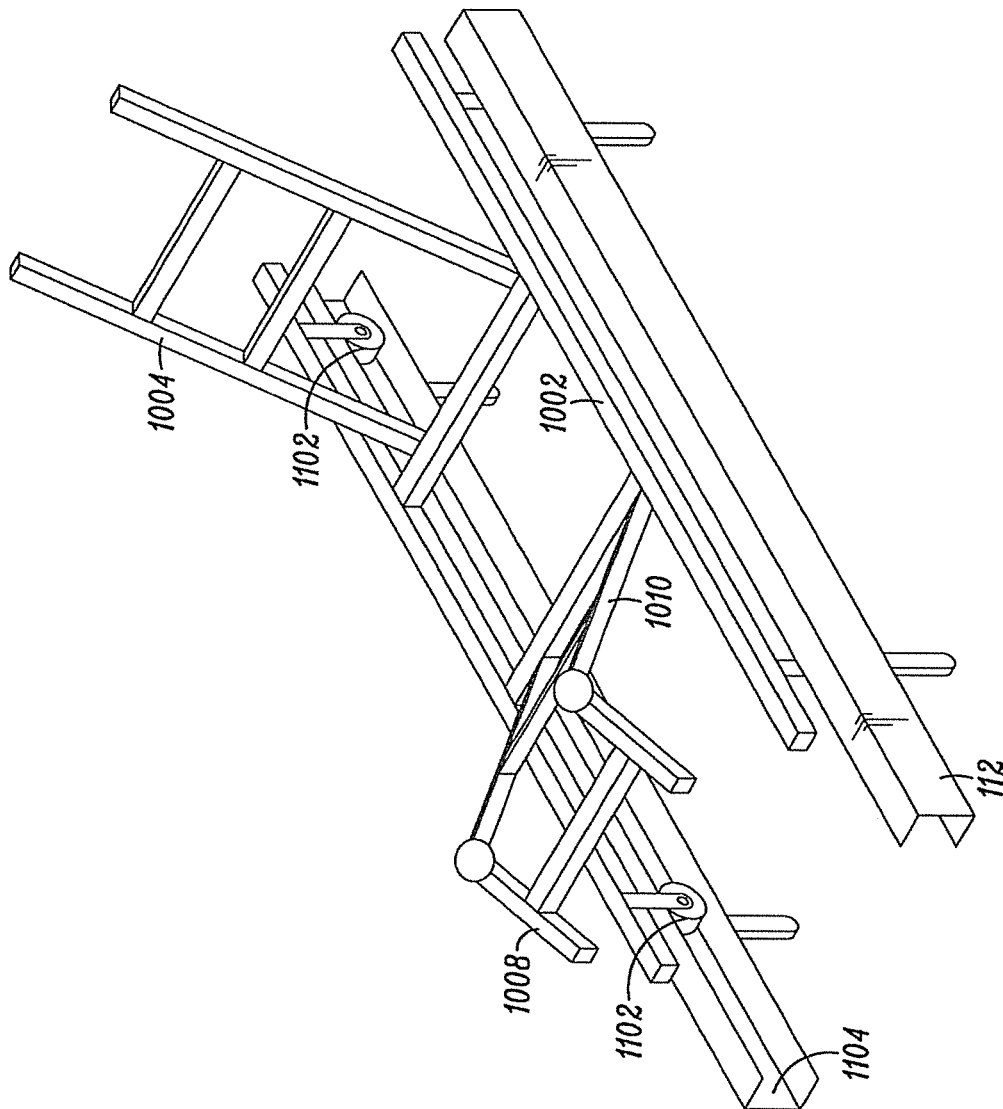


FIG. 11

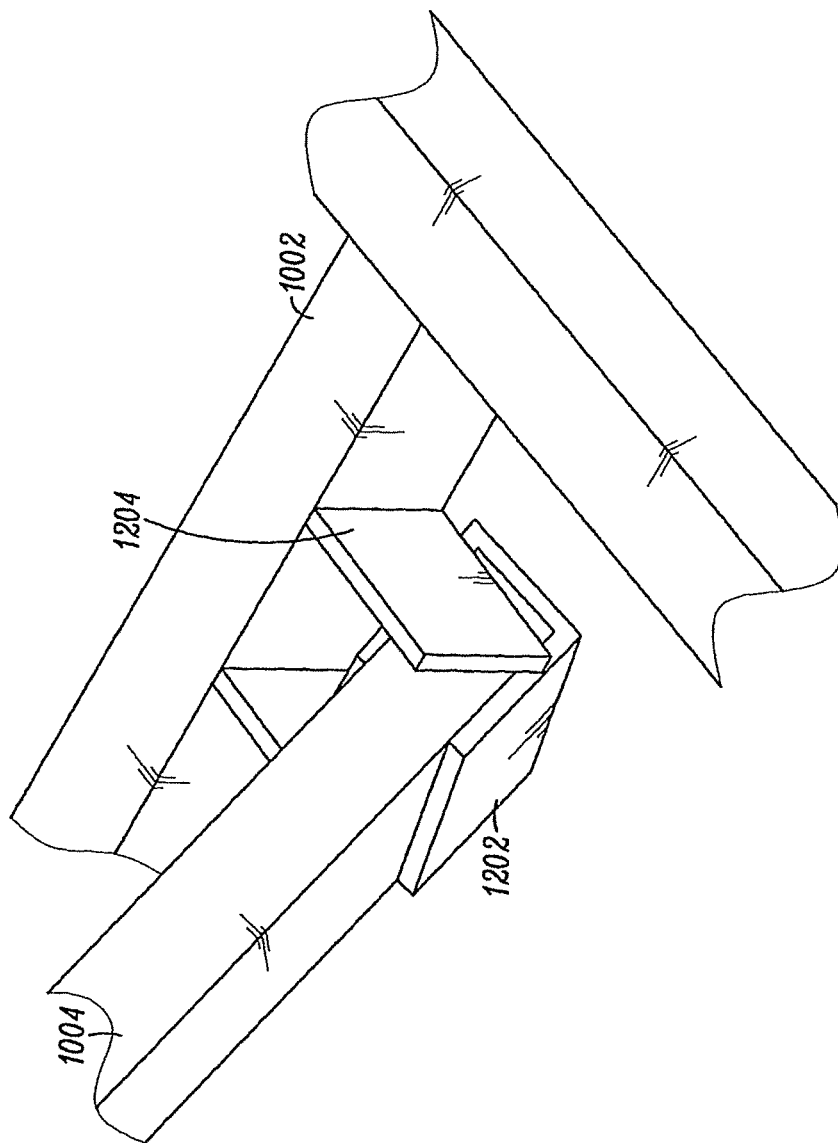


FIG. 12

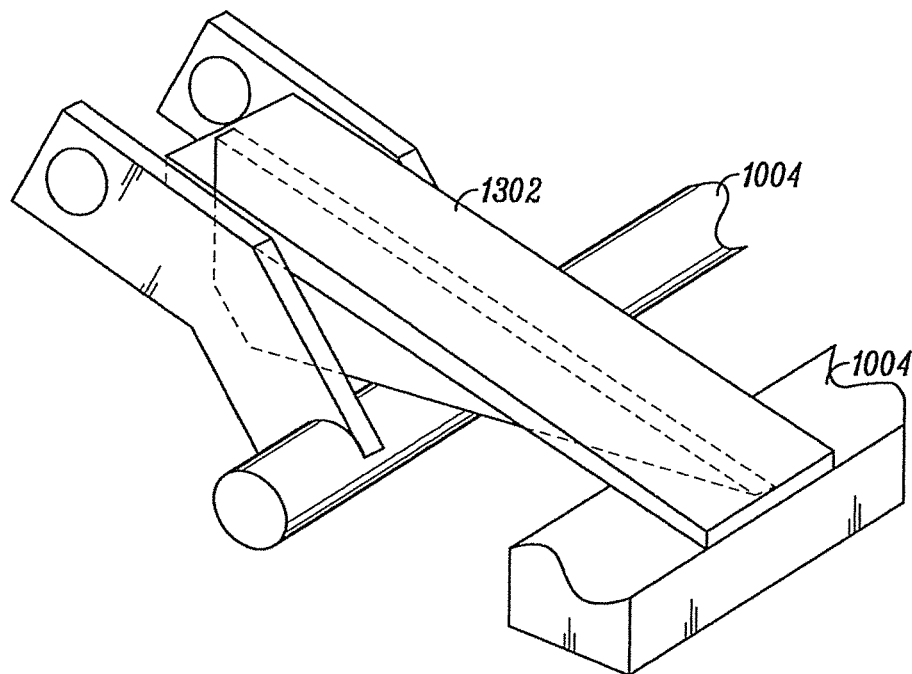


FIG. 13A

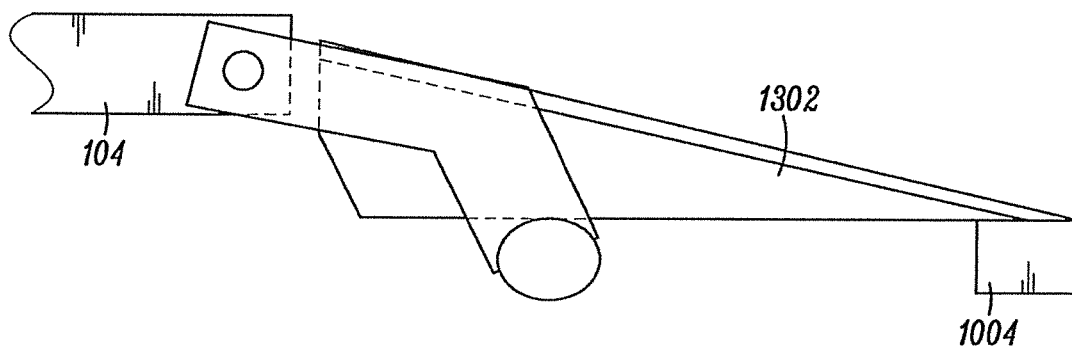


FIG. 13B

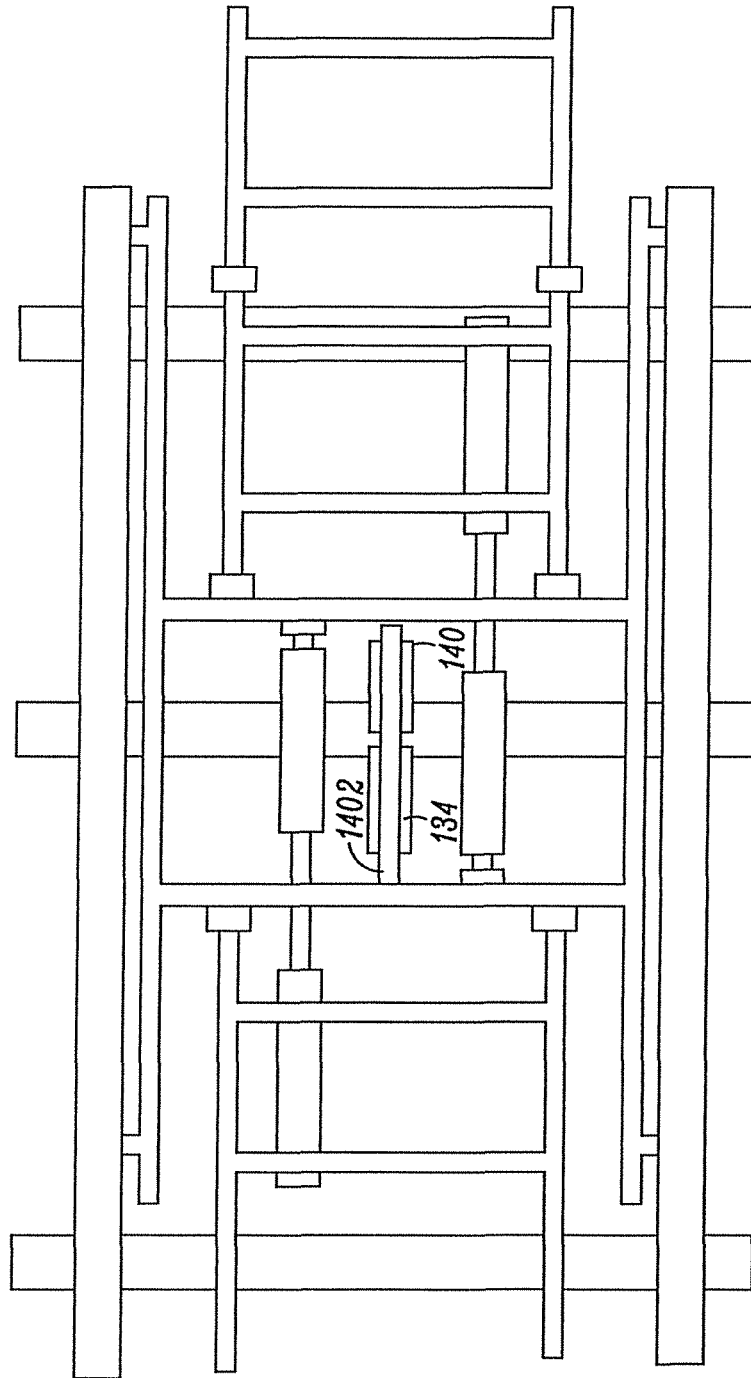


FIG. 14

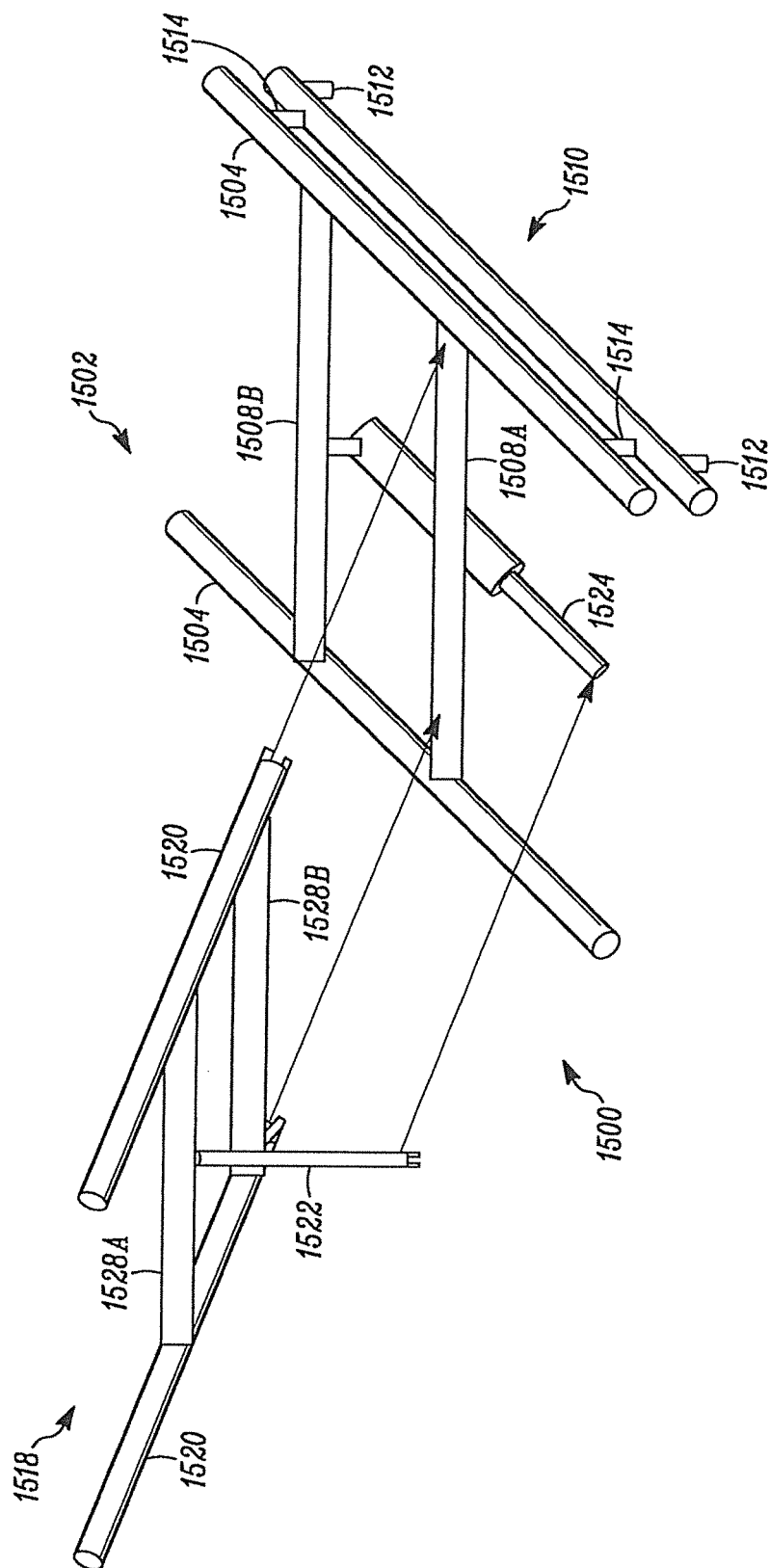


FIG. 15

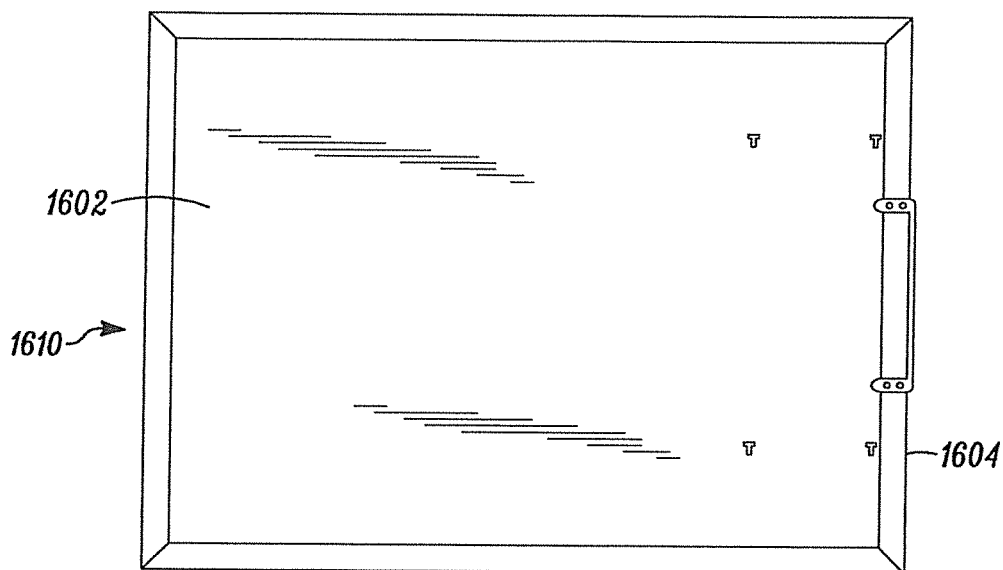


FIG. 16A

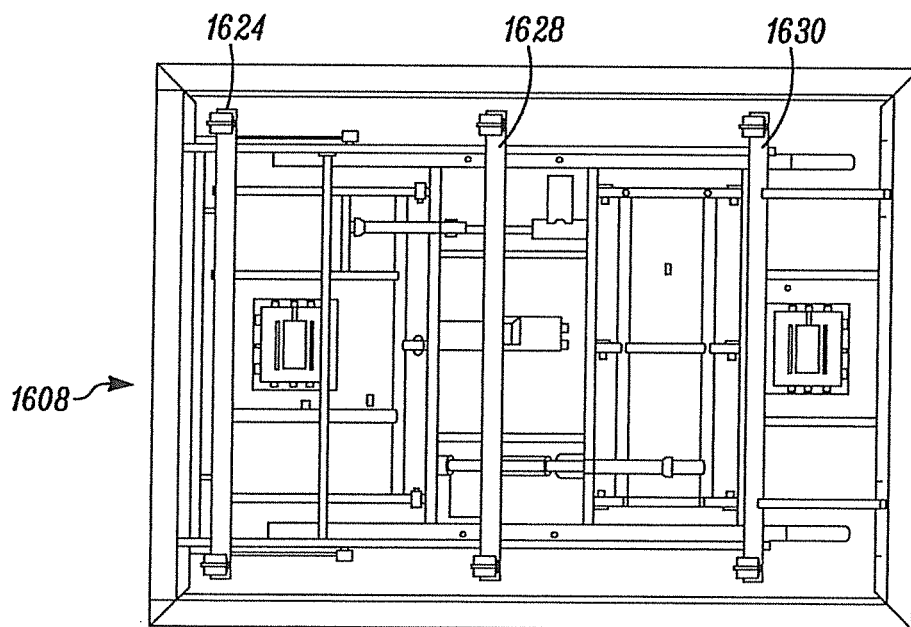


FIG. 16B

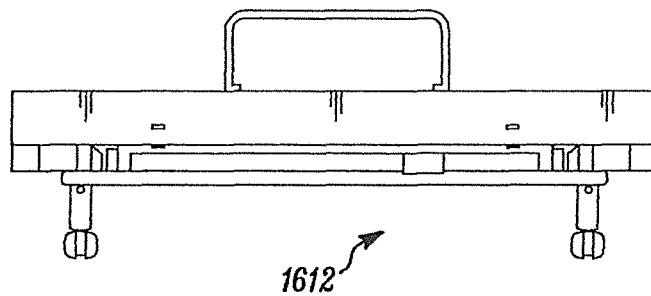


FIG. 16C

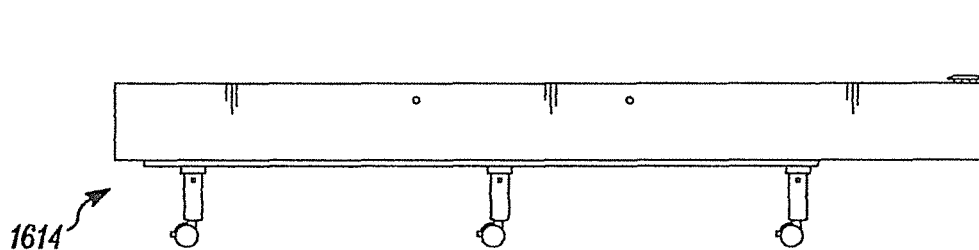


FIG. 16D

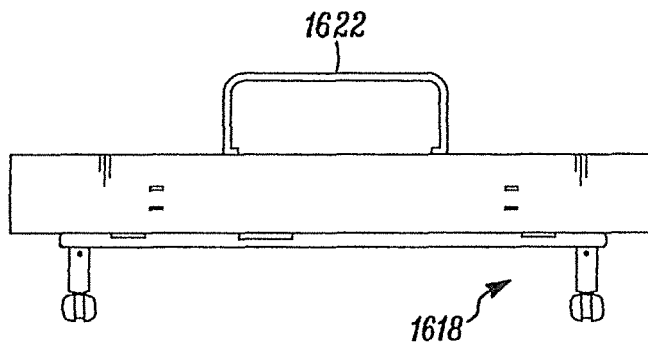


FIG. 16E

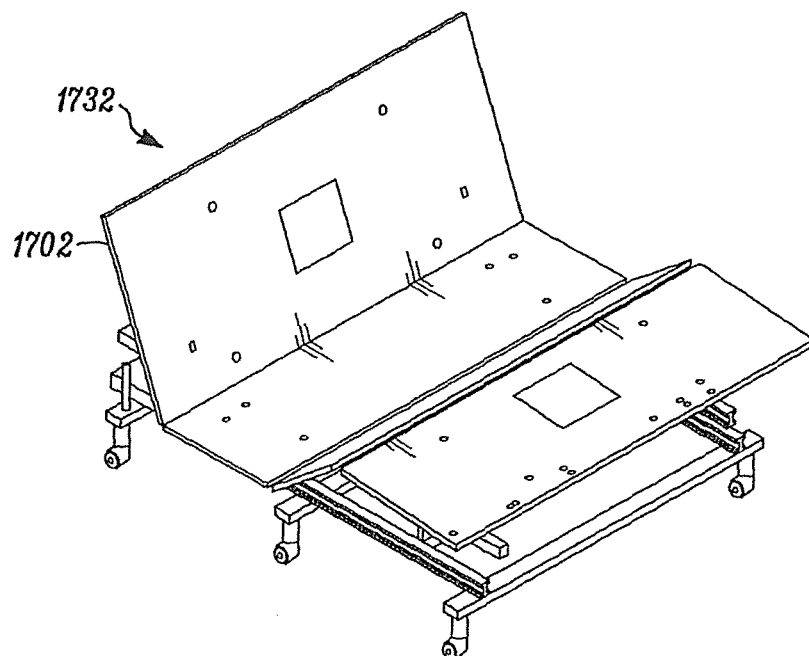


FIG. 17A

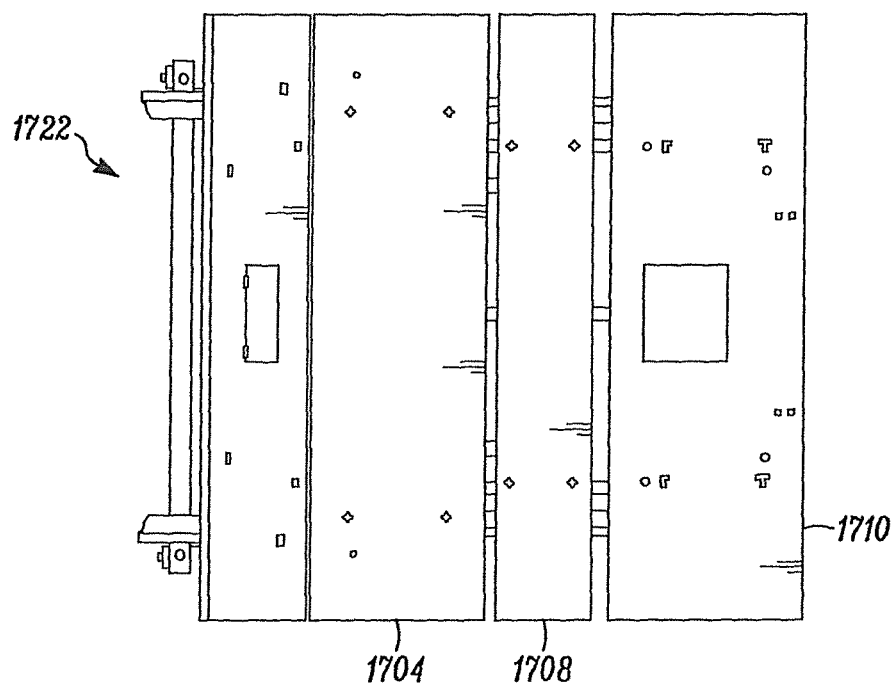


FIG. 17B

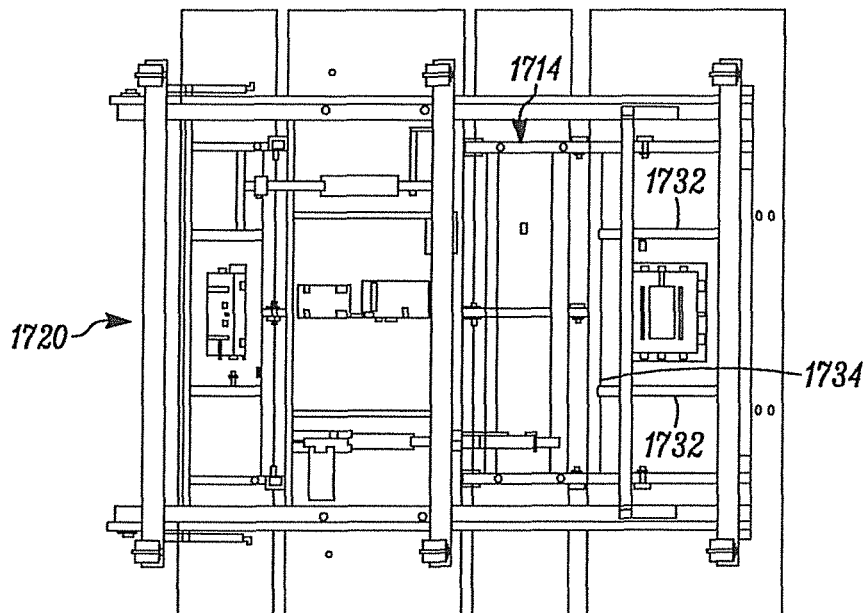


FIG. 17C

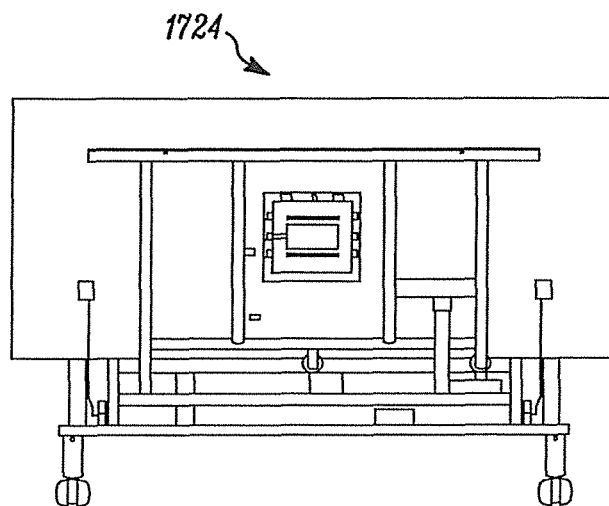


FIG. 17D

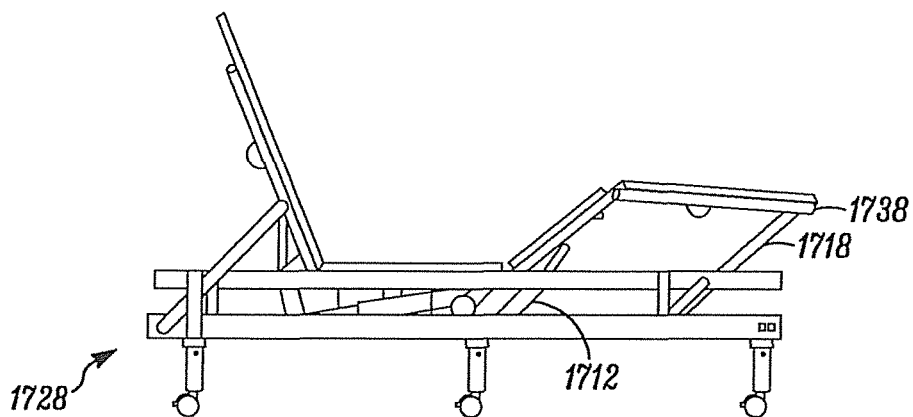


FIG. 17E

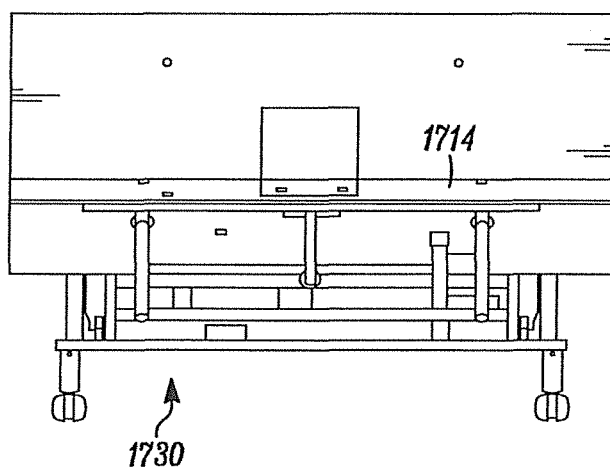


FIG. 17F

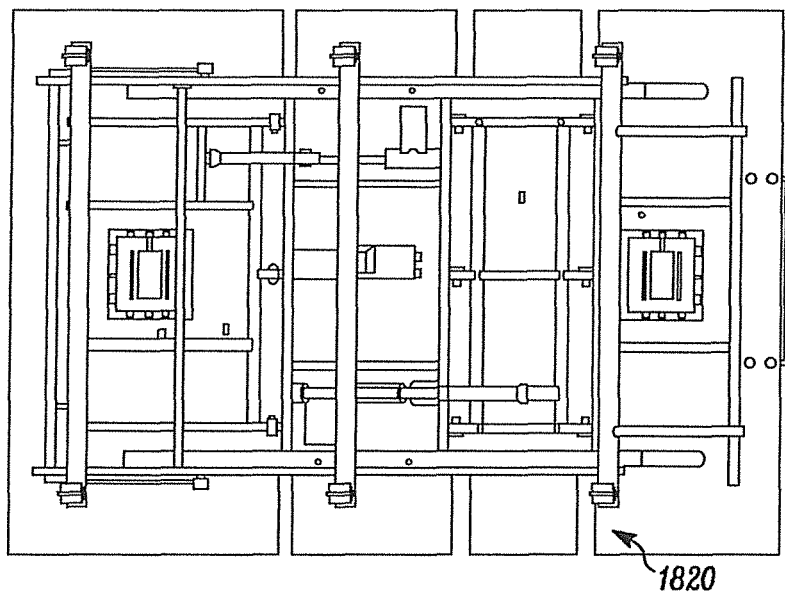


FIG. 18A

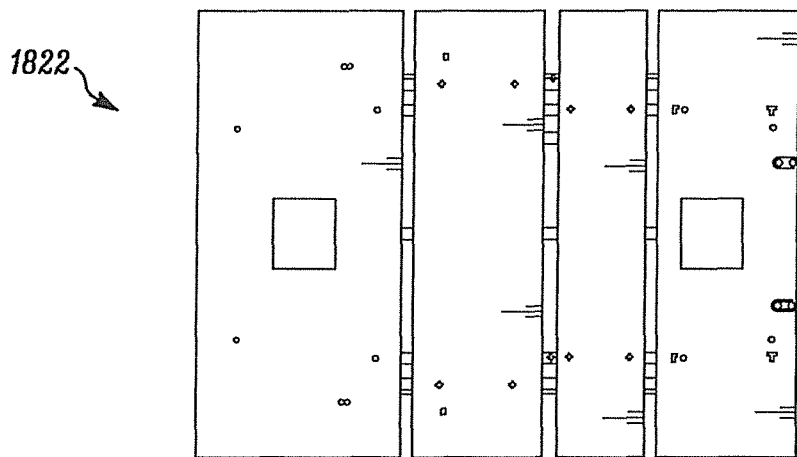


FIG. 18B

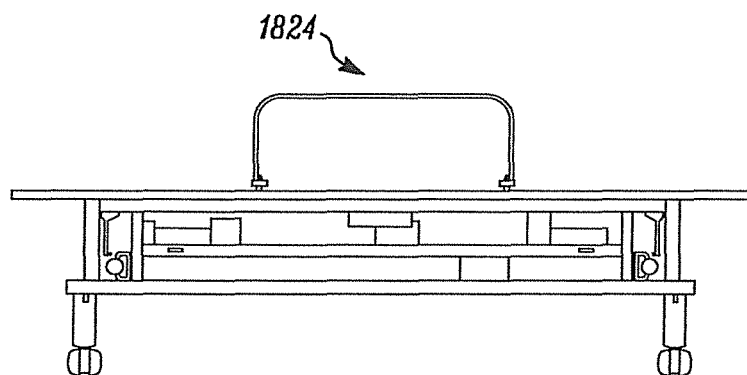


FIG. 18C

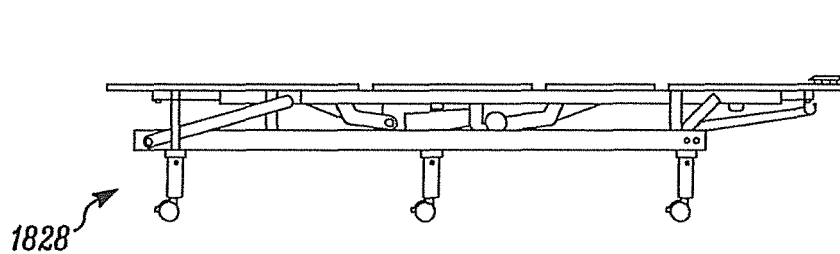


FIG. 18D

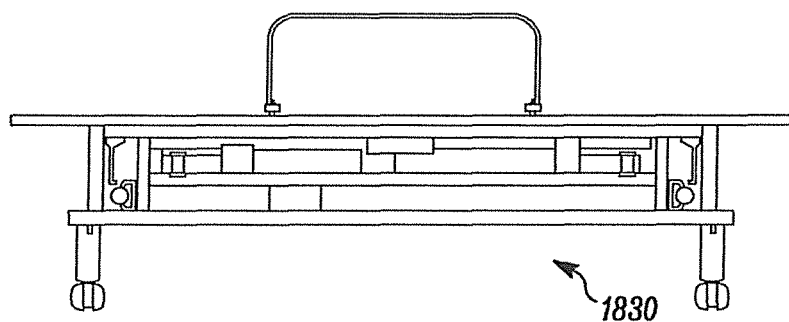


FIG. 18E

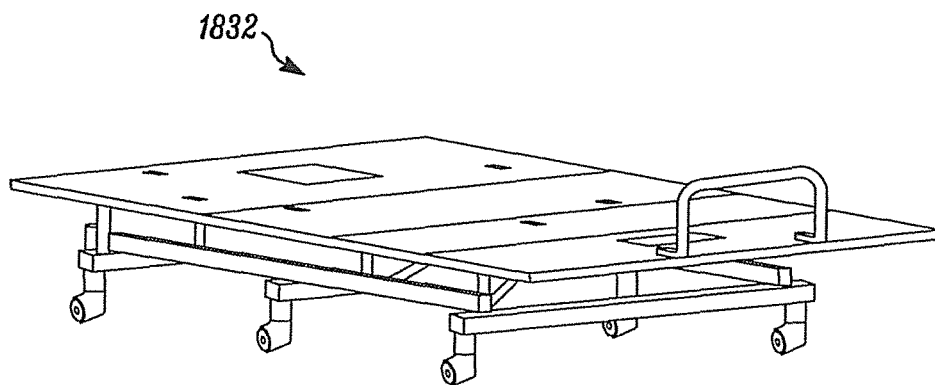


FIG. 18F

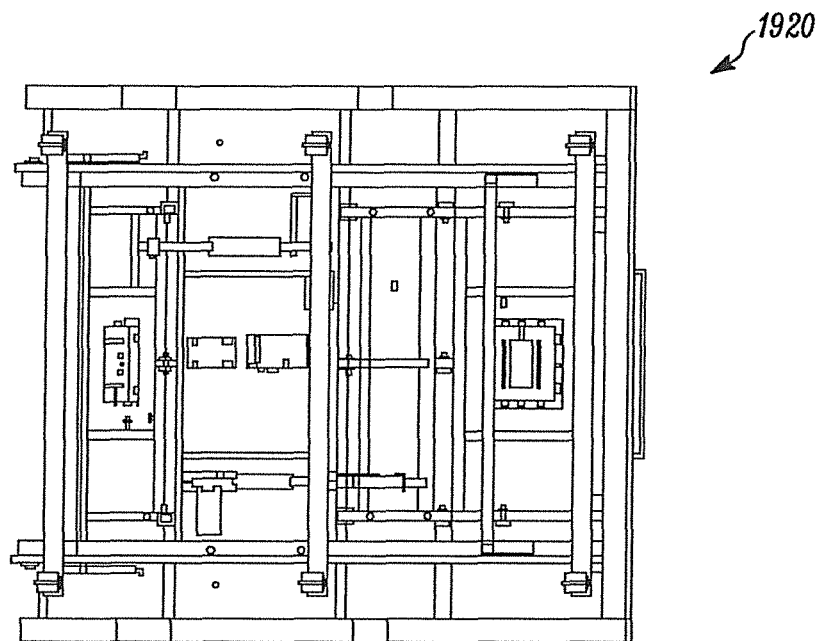


FIG. 19A

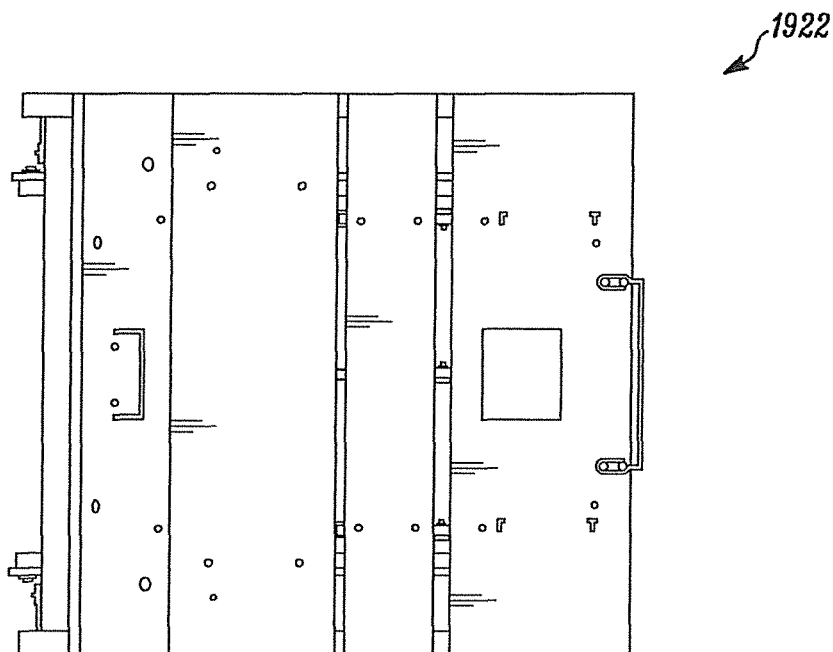


FIG. 19B

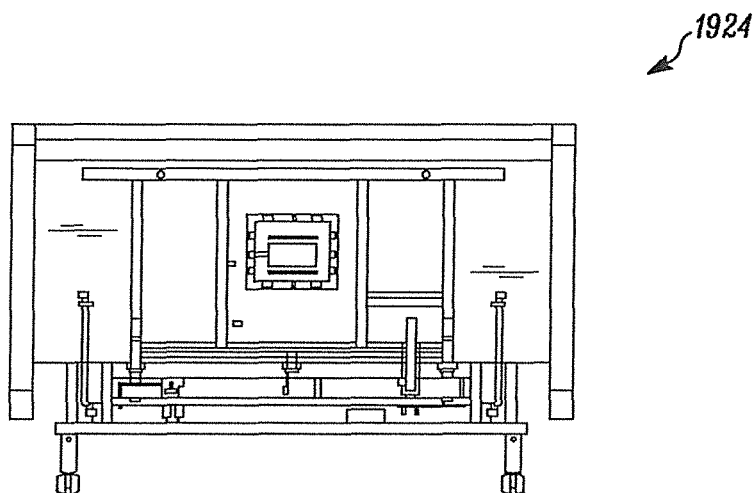


FIG. 19C

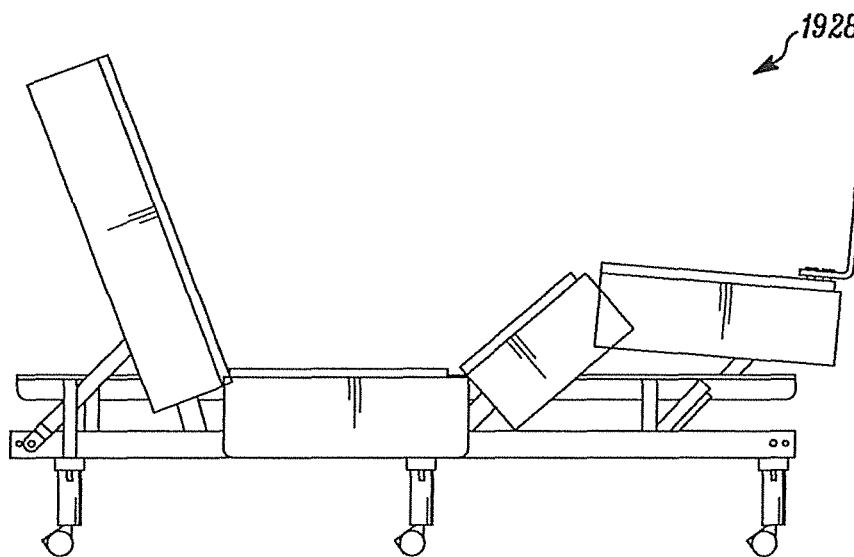


FIG. 19D

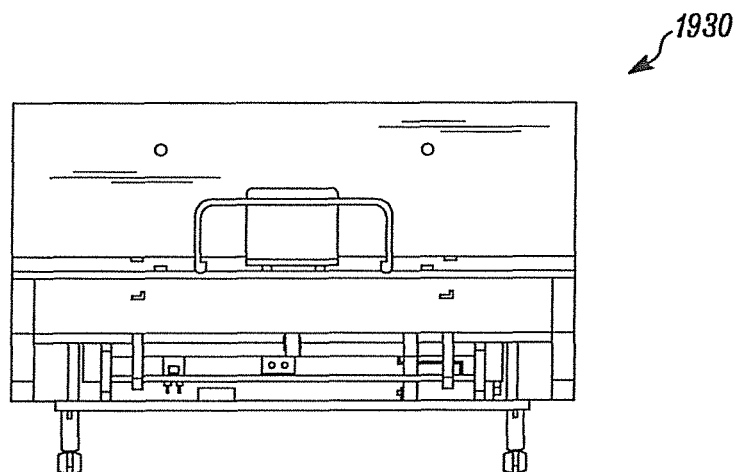


FIG. 19E

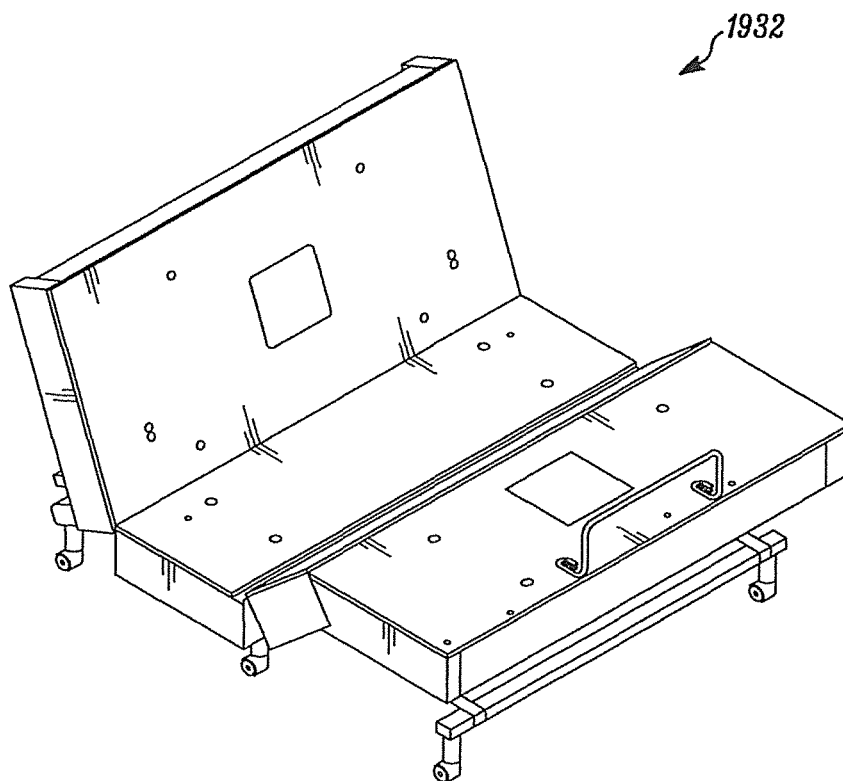


FIG. 19F

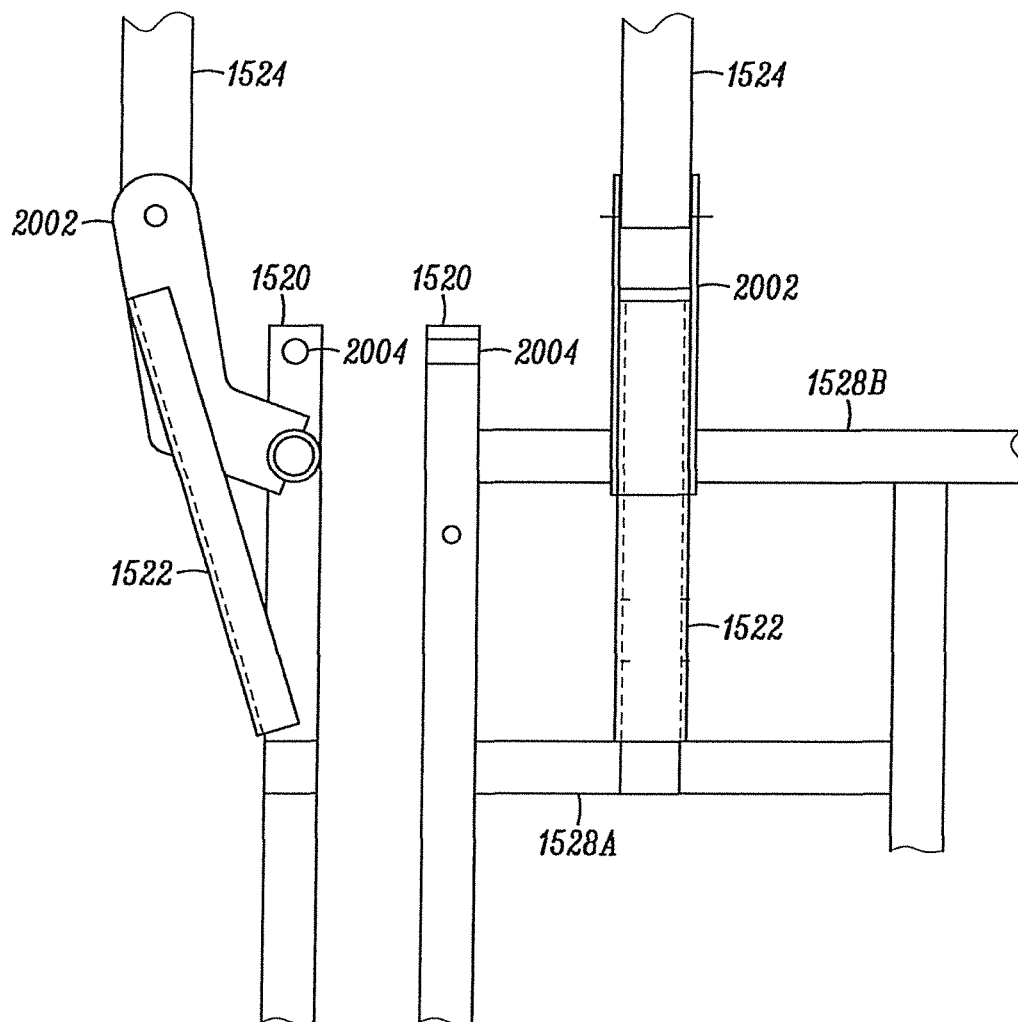


FIG. 20

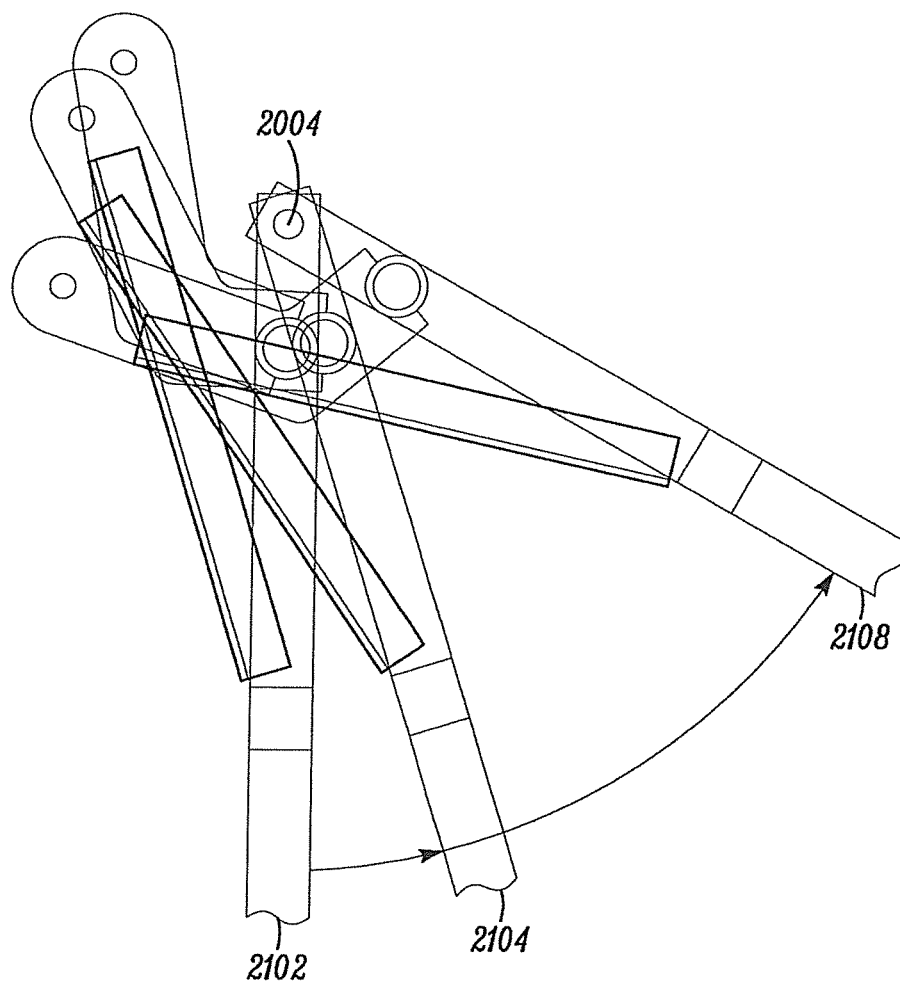


FIG. 21

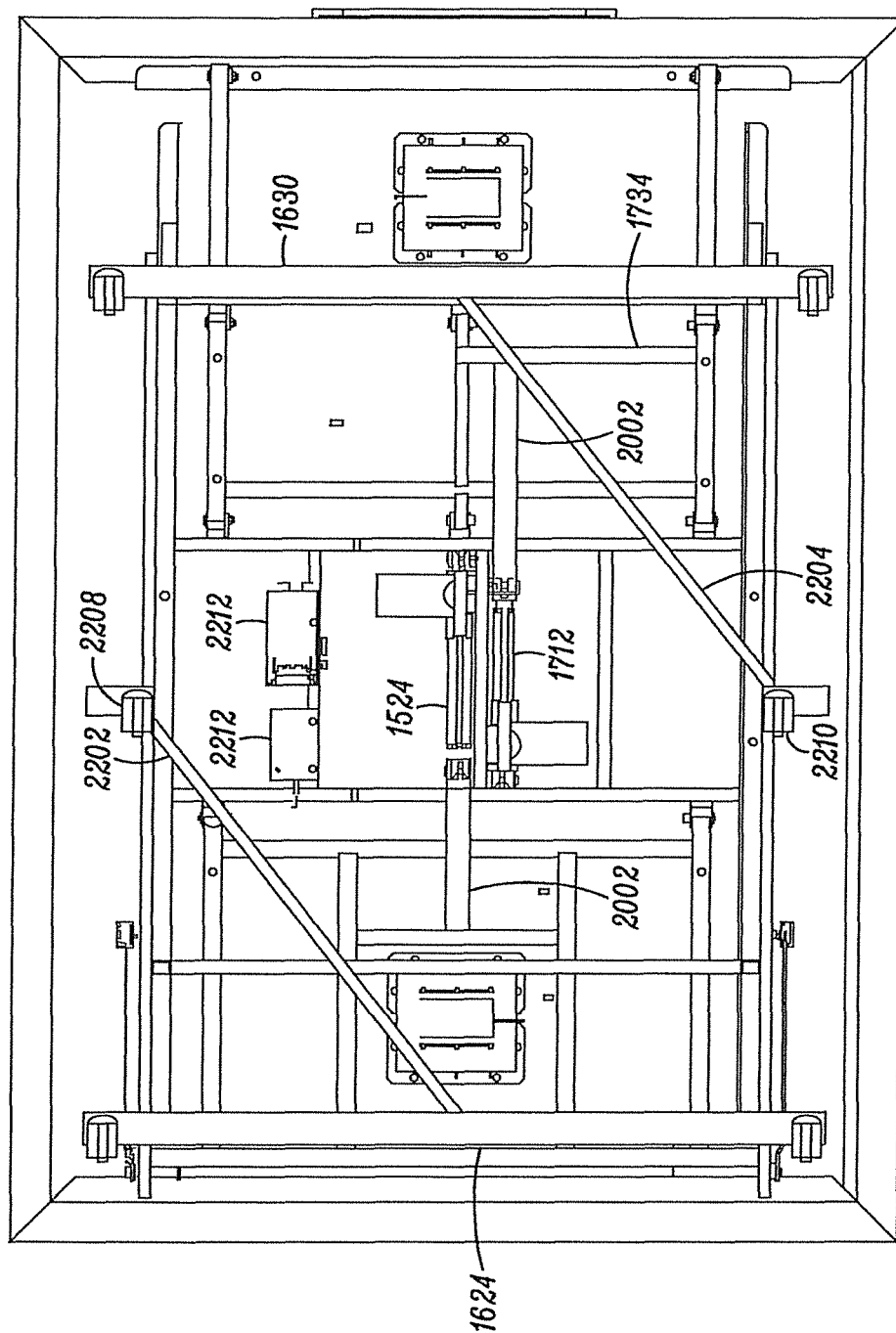


FIG. 22

2300

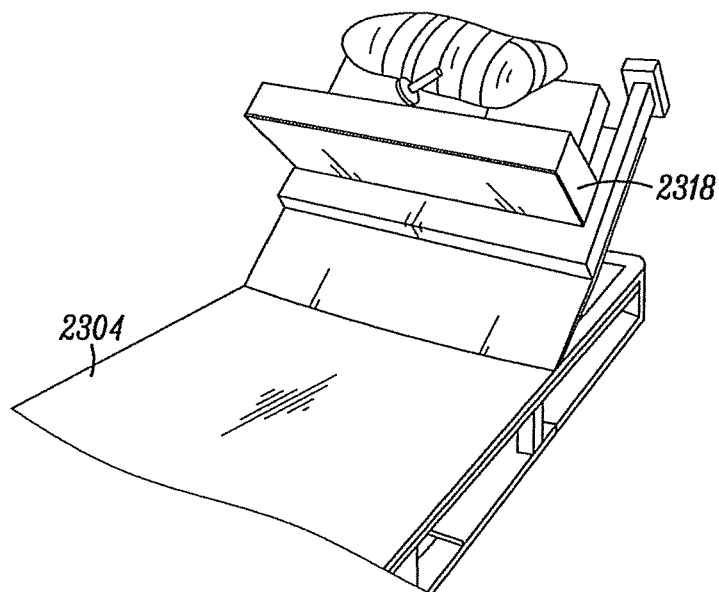


FIG. 23A

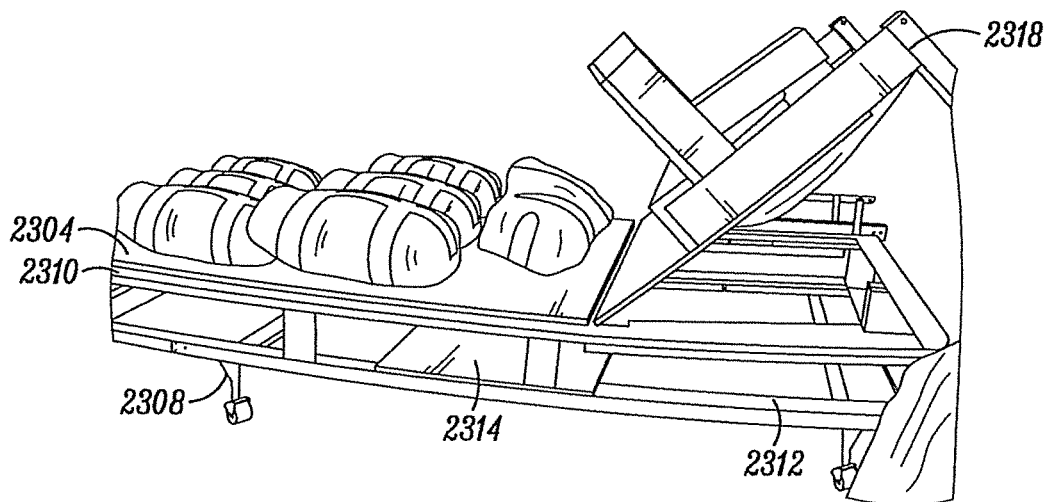


FIG. 23B

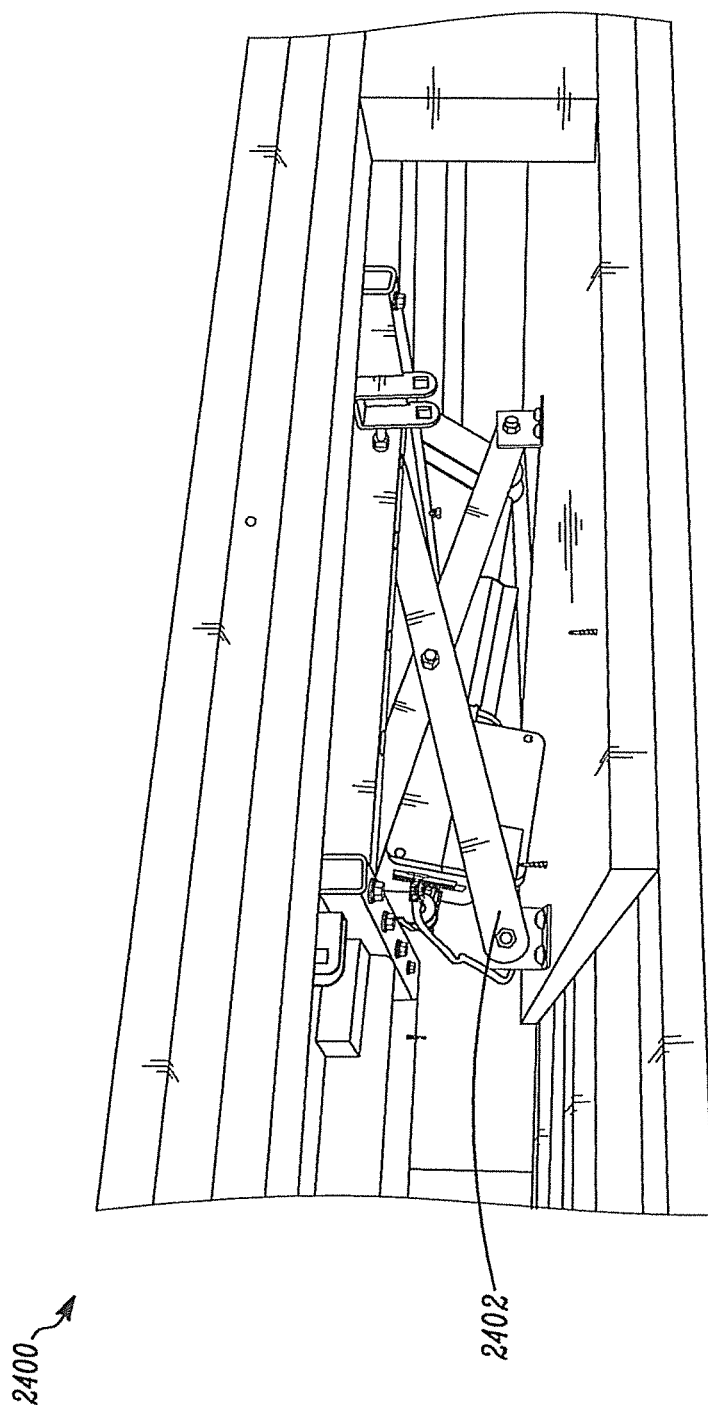


FIG. 24

2500 ↗

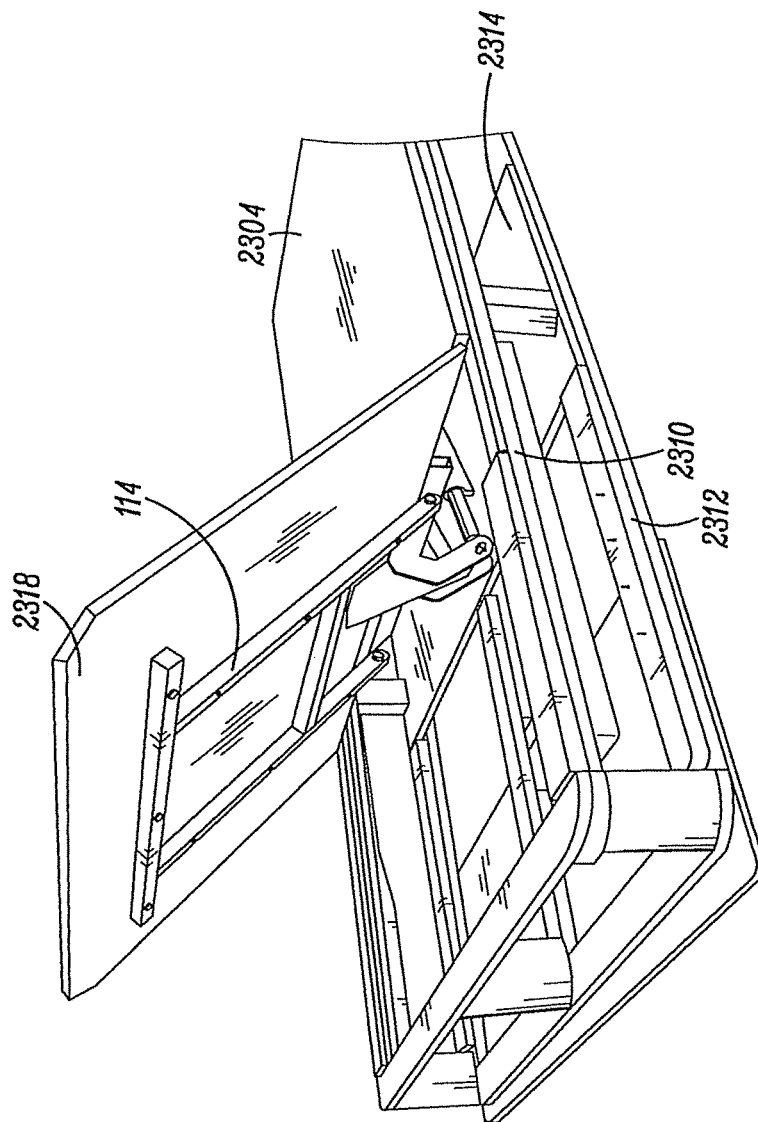


FIG. 25

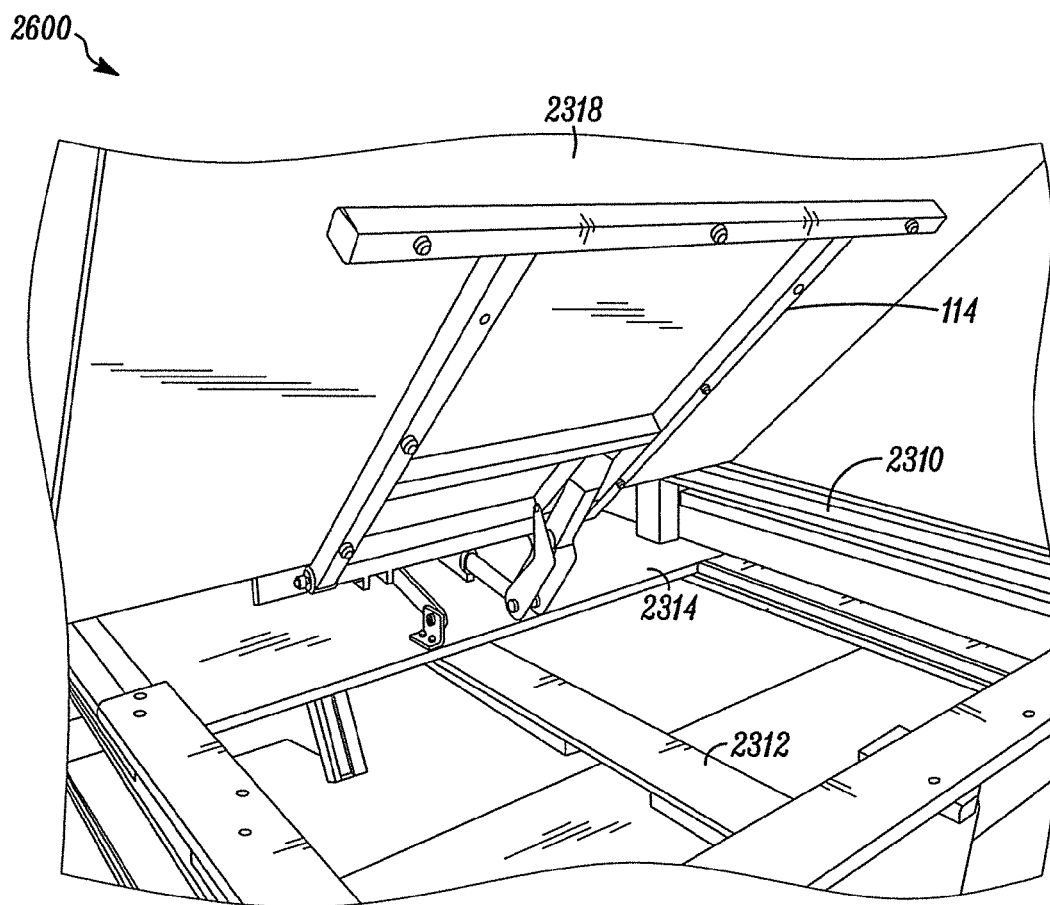


FIG. 26

2700

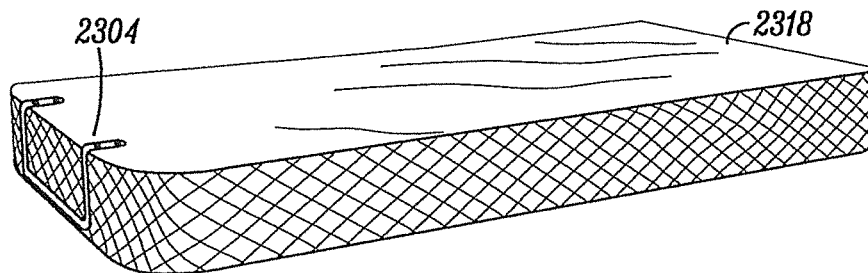


FIG. 27A

2700

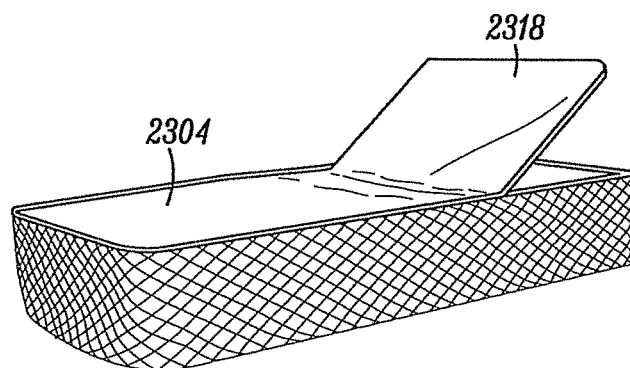


FIG. 27B

2800

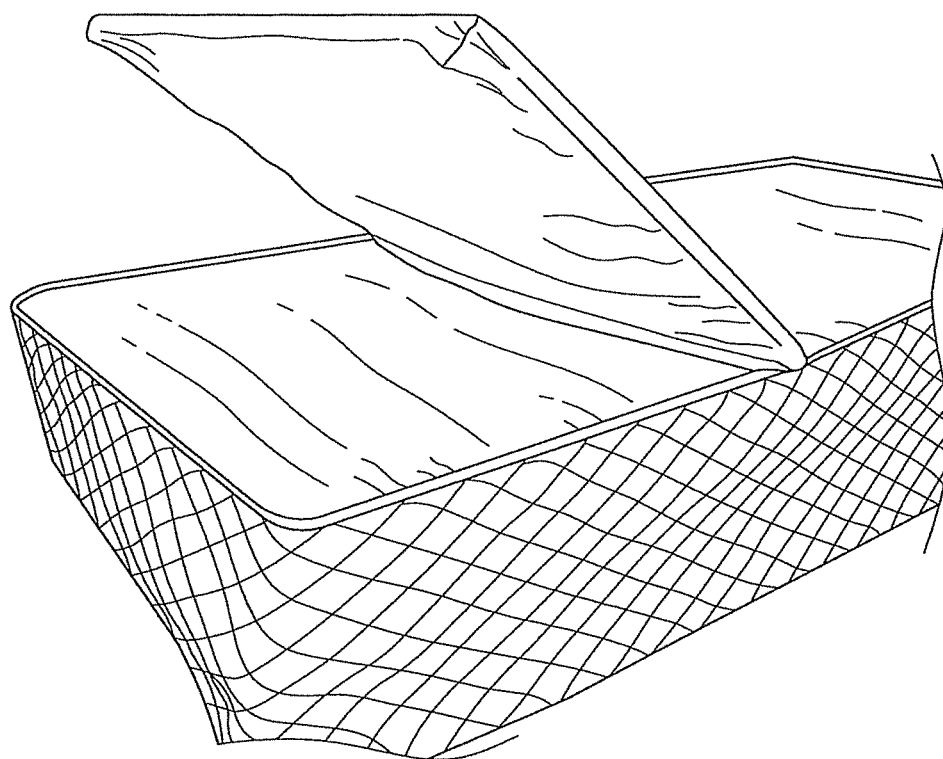


FIG. 28

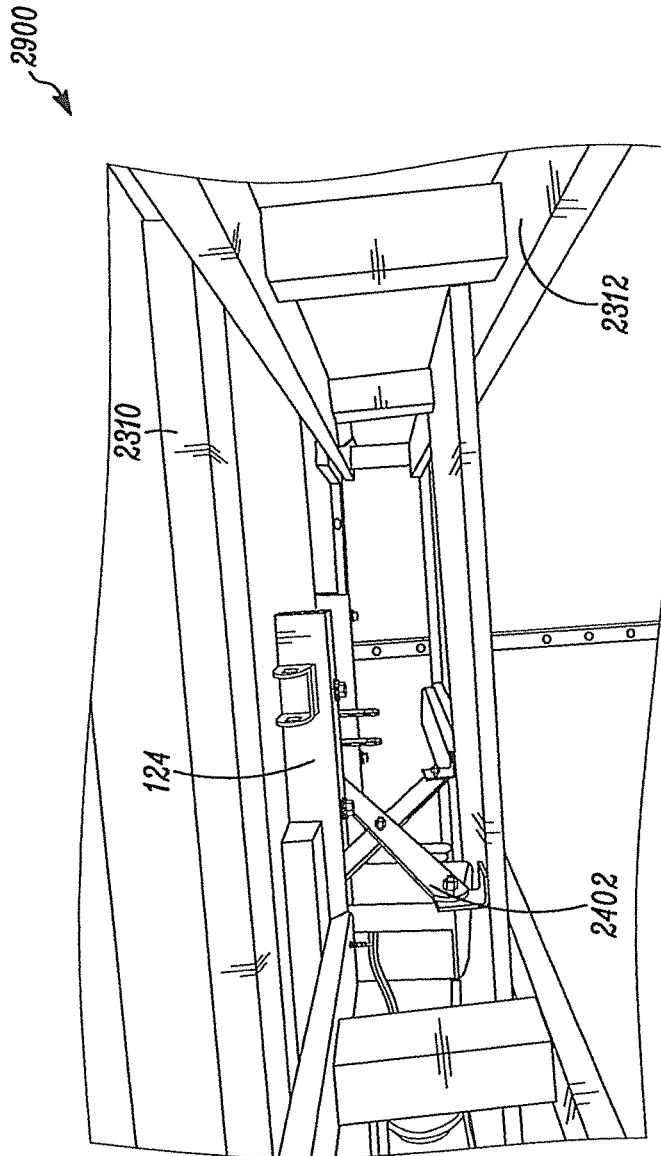


FIG. 29

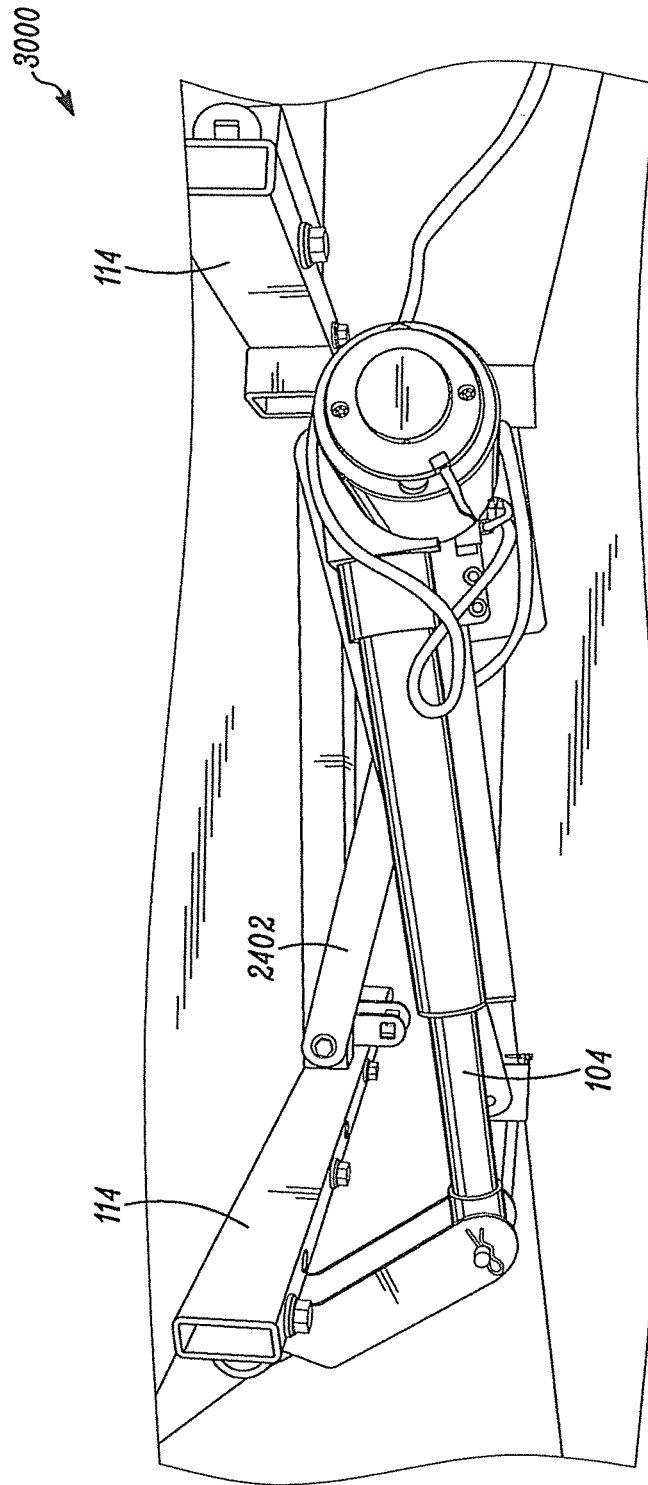


FIG. 30

3100

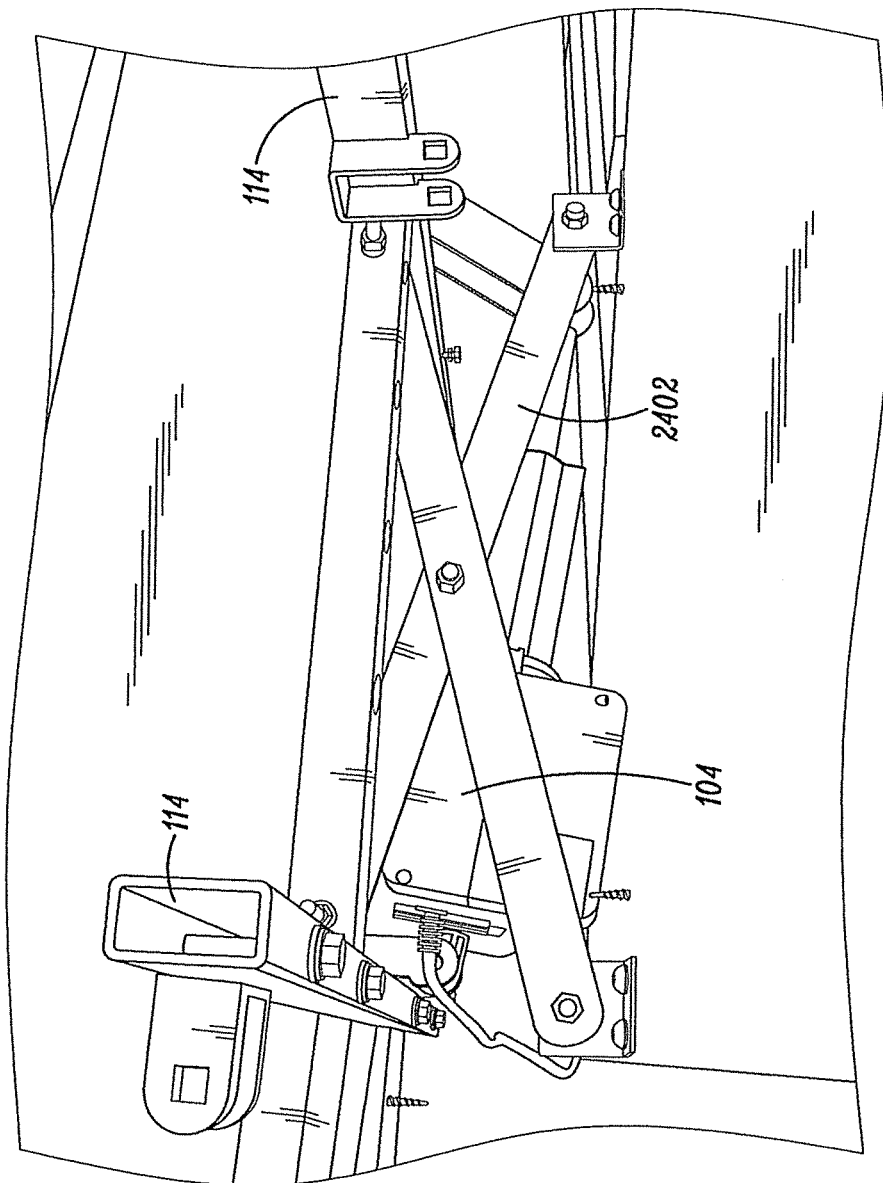


FIG. 31

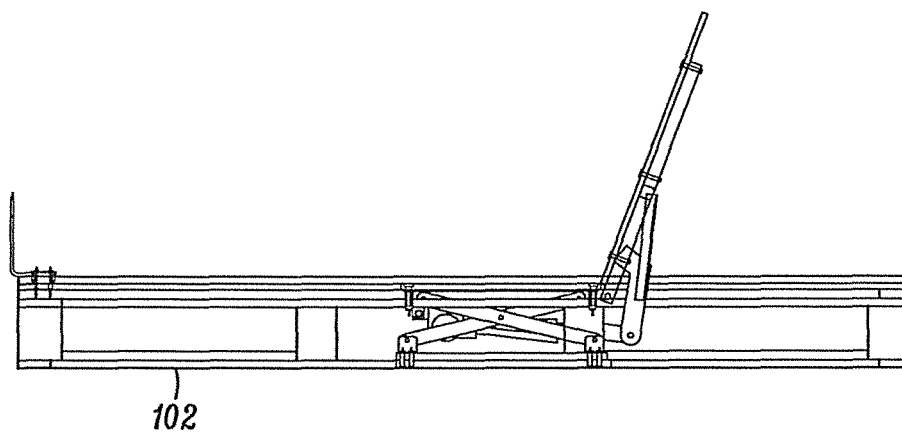


FIG. 32A

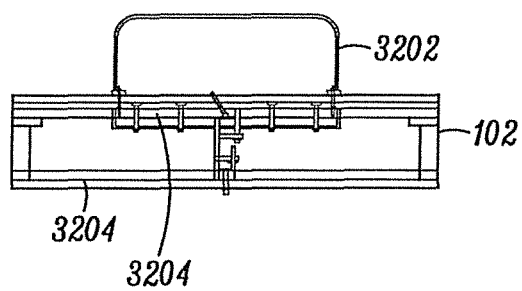


FIG. 32B

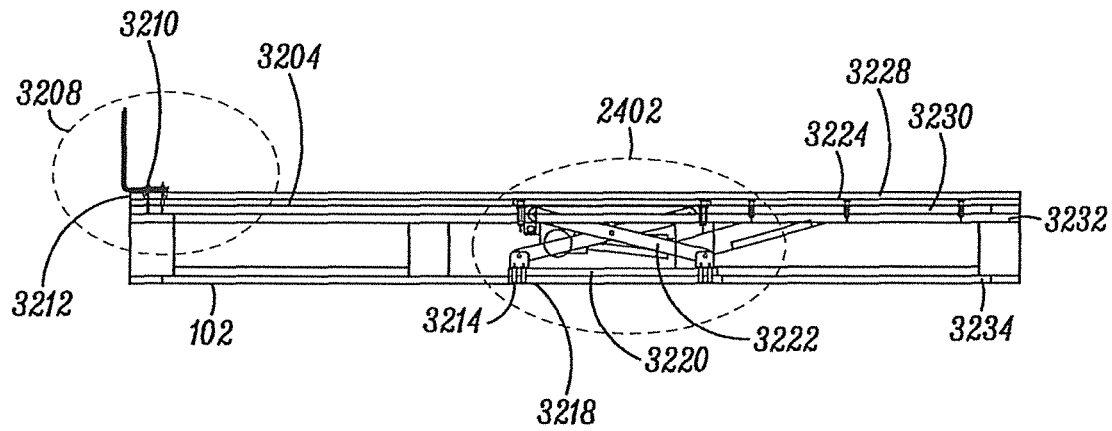


FIG. 32C

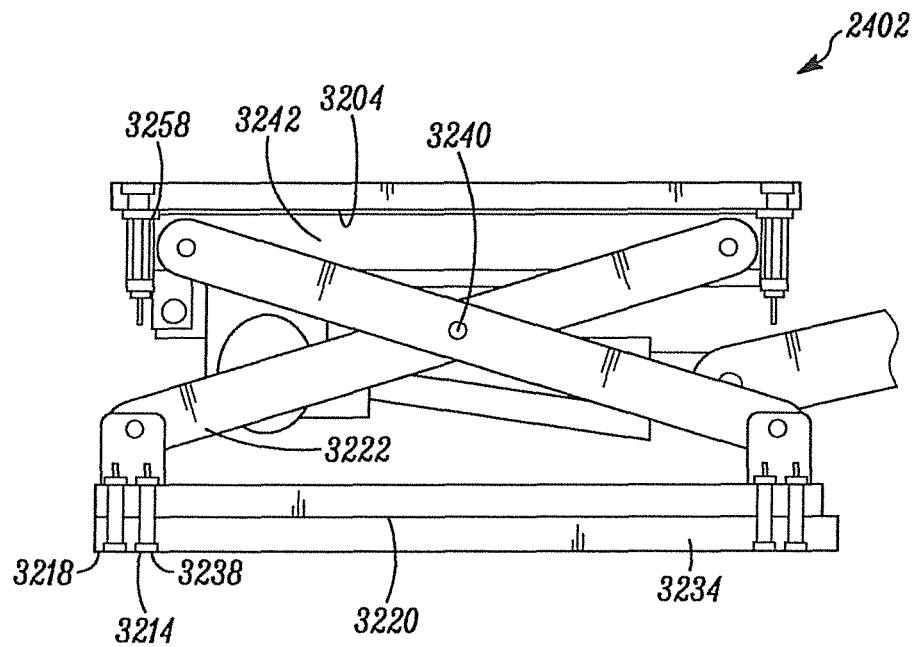


FIG. 32D

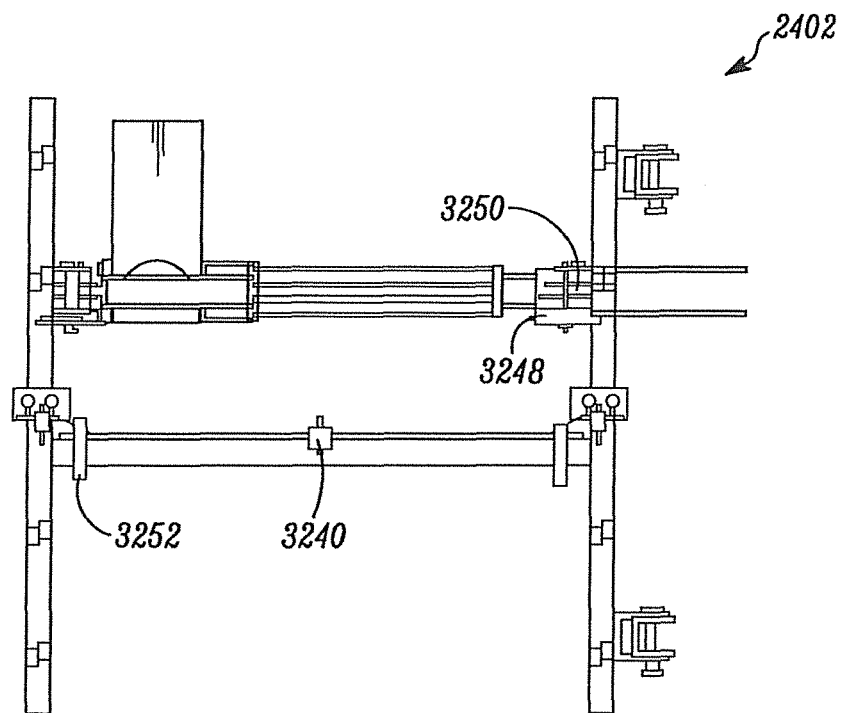


FIG. 32E

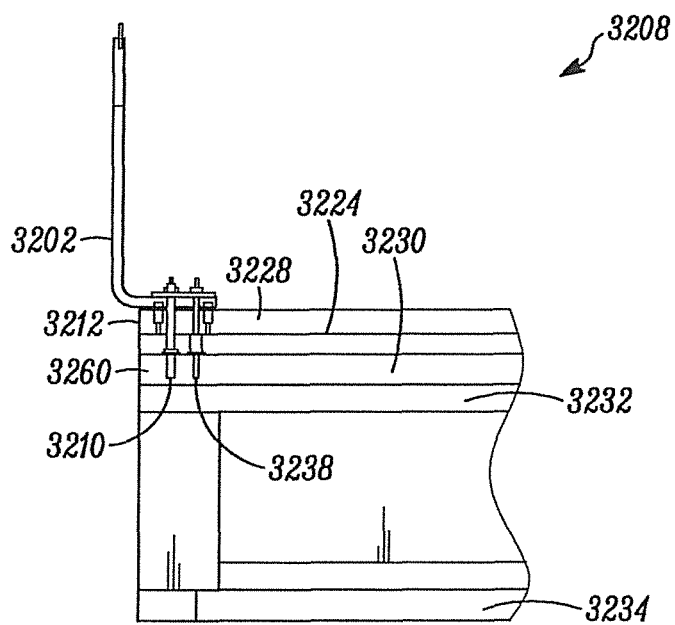


FIG. 32F

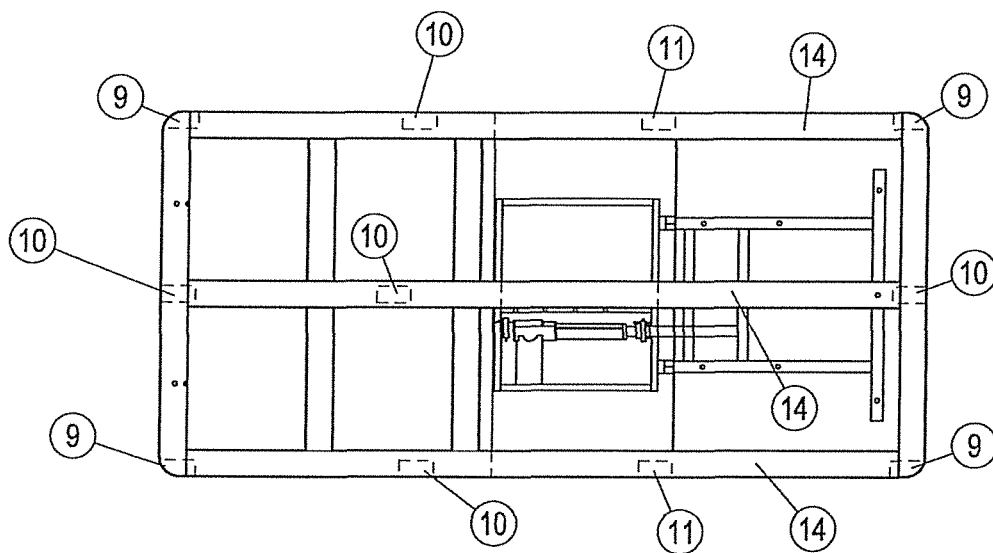


FIG. 32G

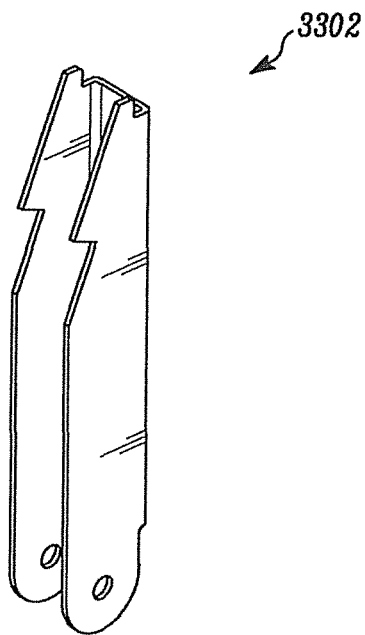


FIG. 33

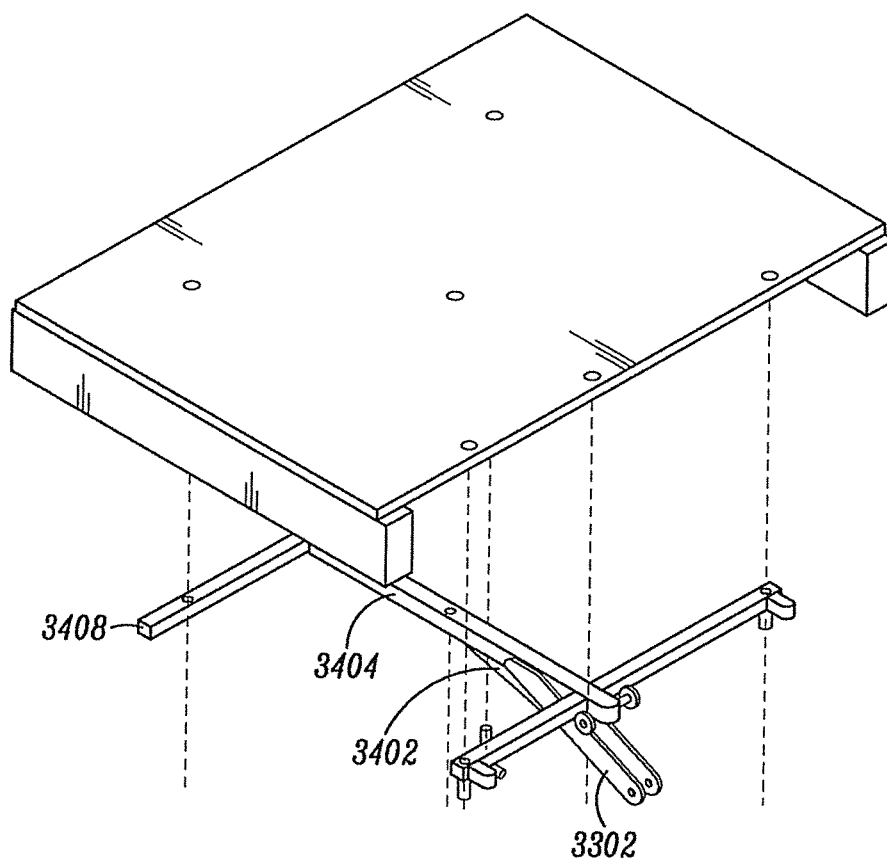


FIG. 34

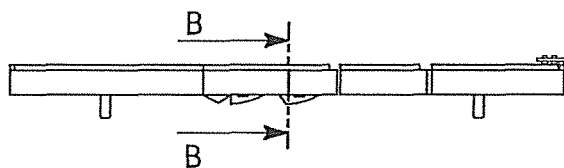


FIG. 35A

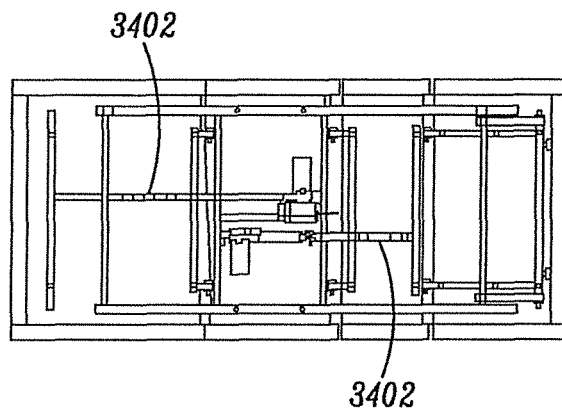


FIG. 35B

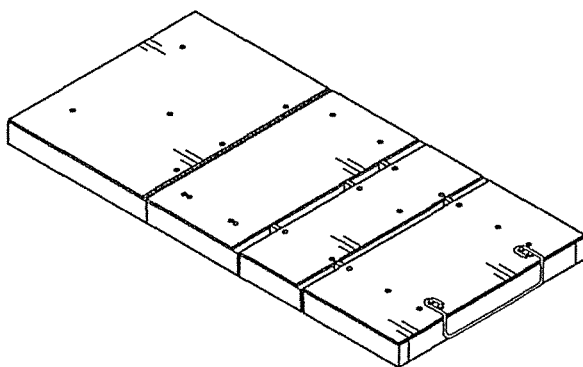


FIG. 35C

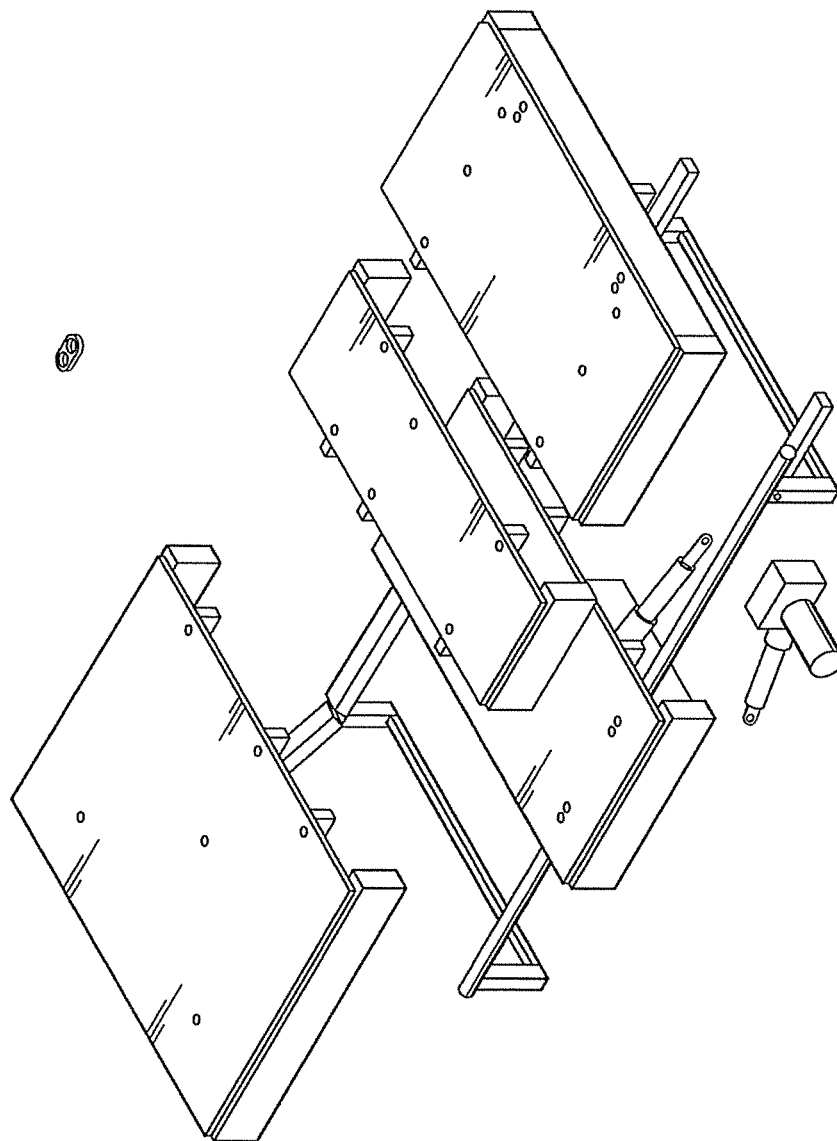


FIG. 36

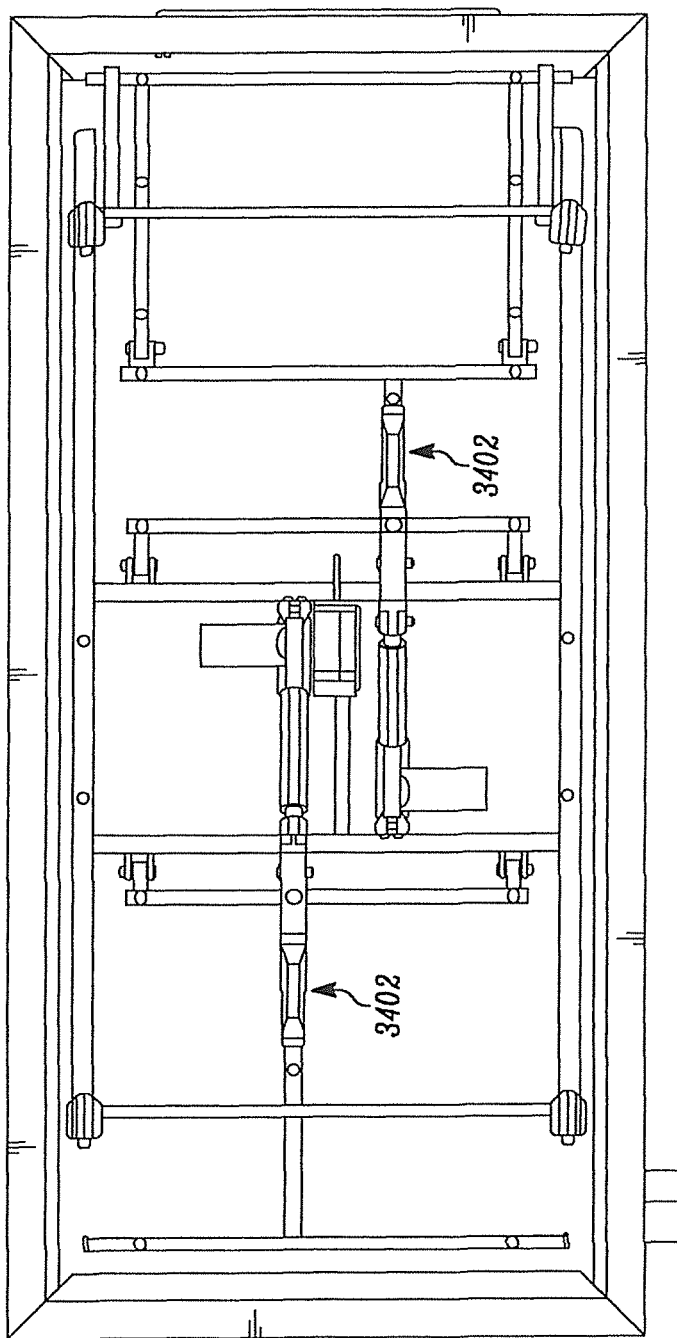


FIG. 37

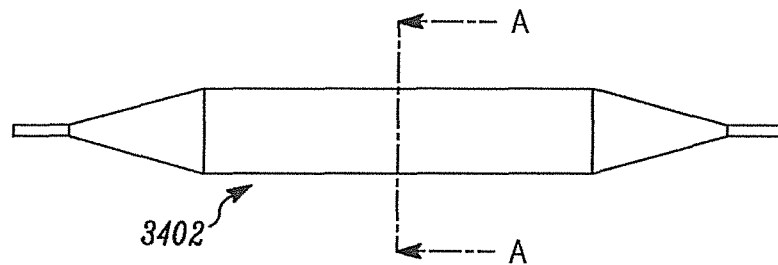


FIG. 38A

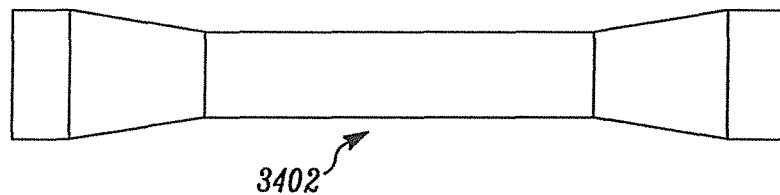


FIG. 38B

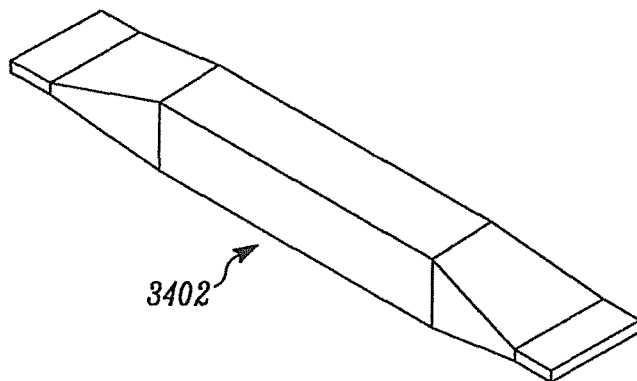


FIG. 38C

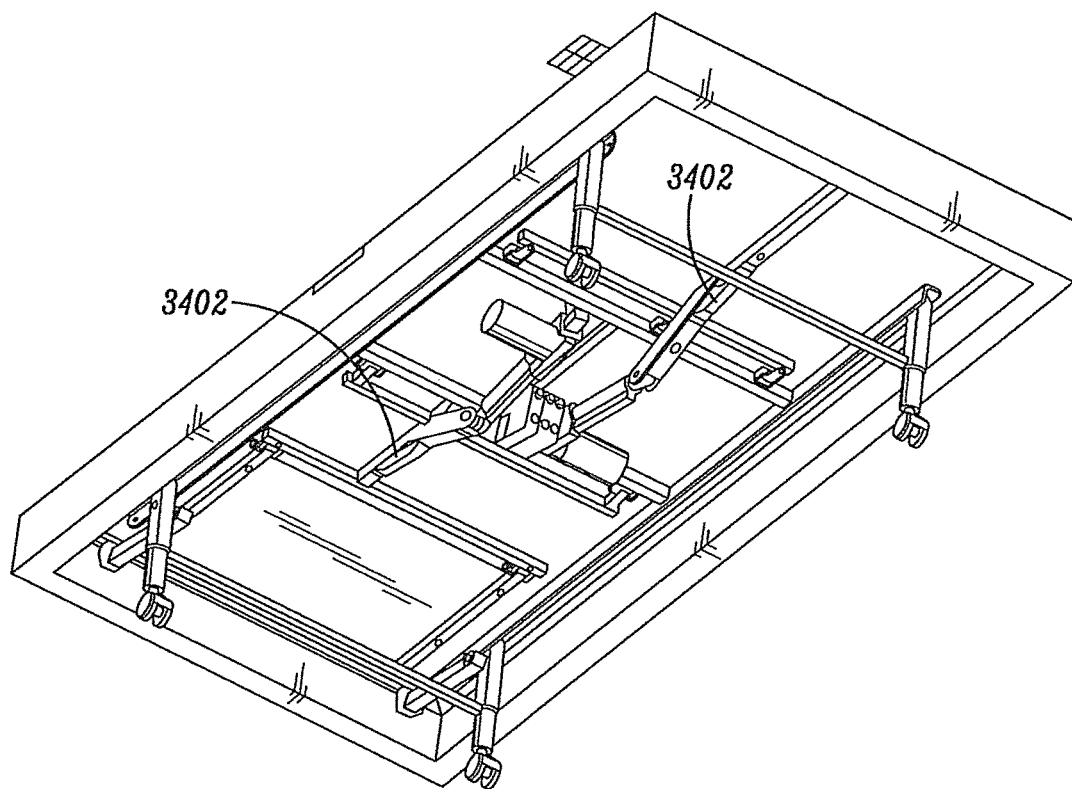


FIG. 39

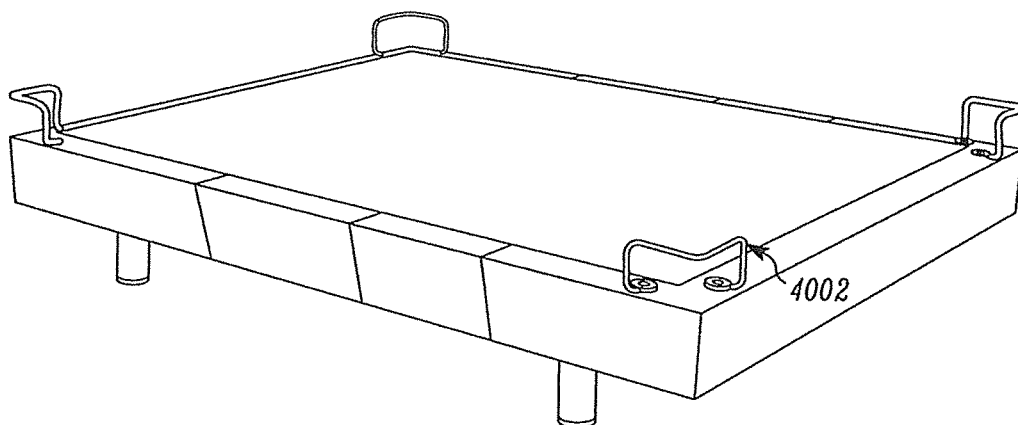


FIG. 40A

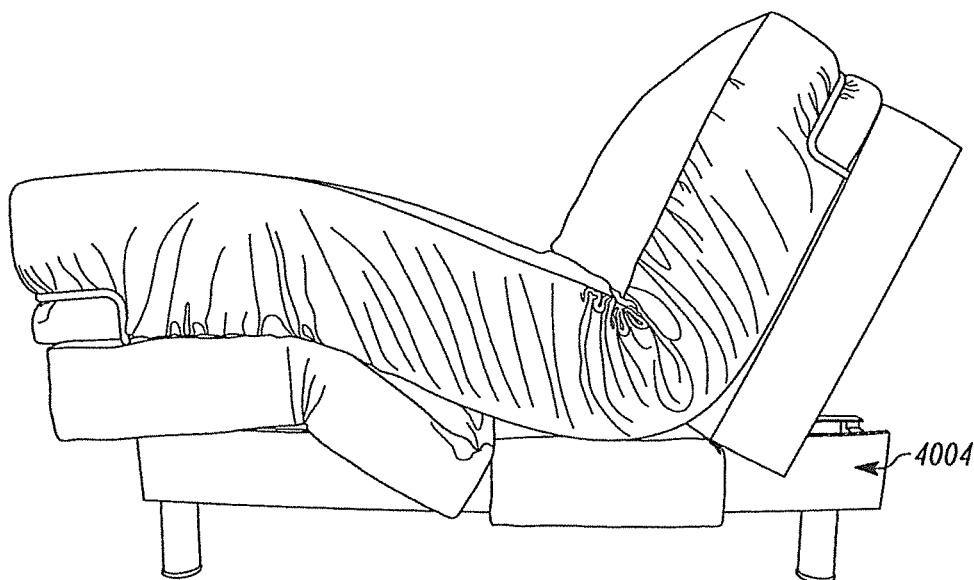


FIG. 40B

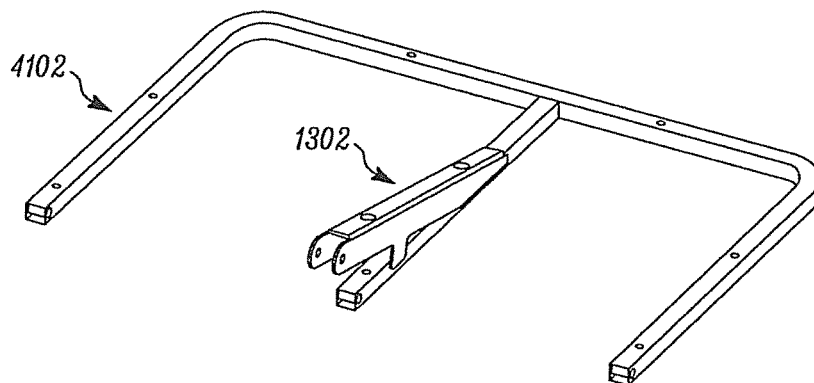


FIG. 41A

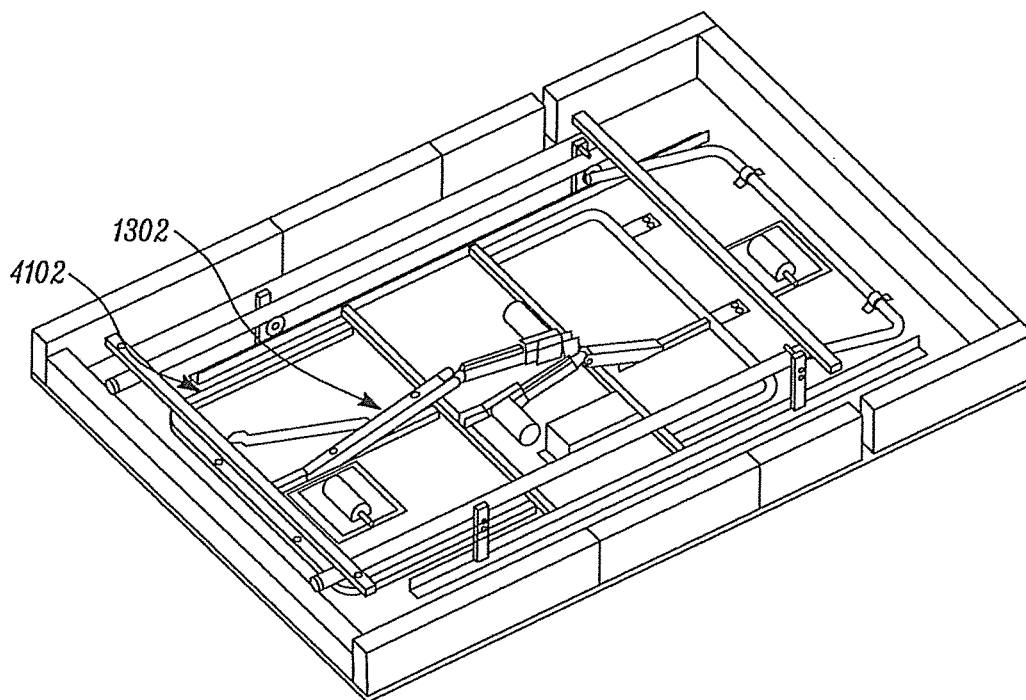


FIG. 41B

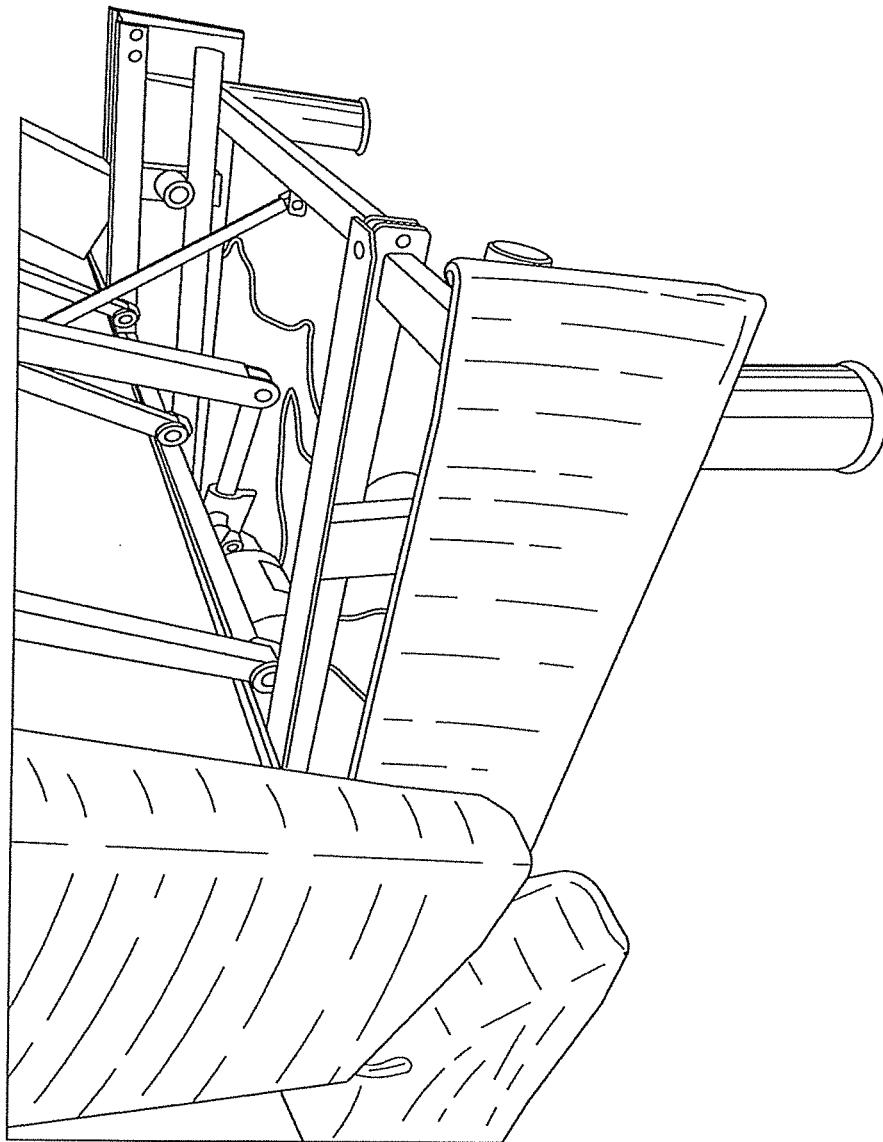


FIG. 42

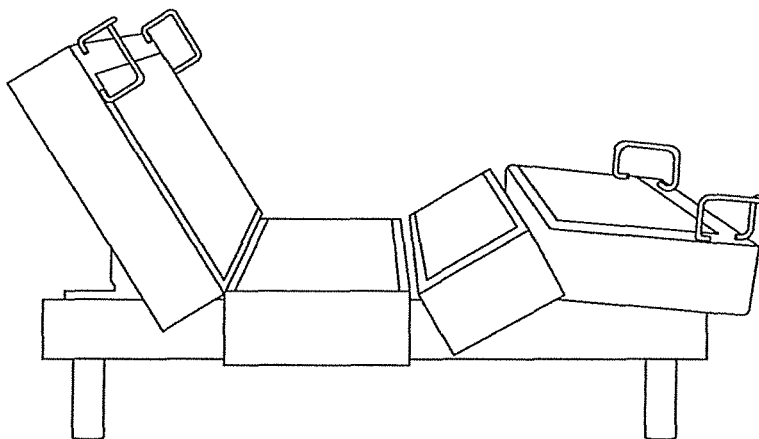


FIG. 43A

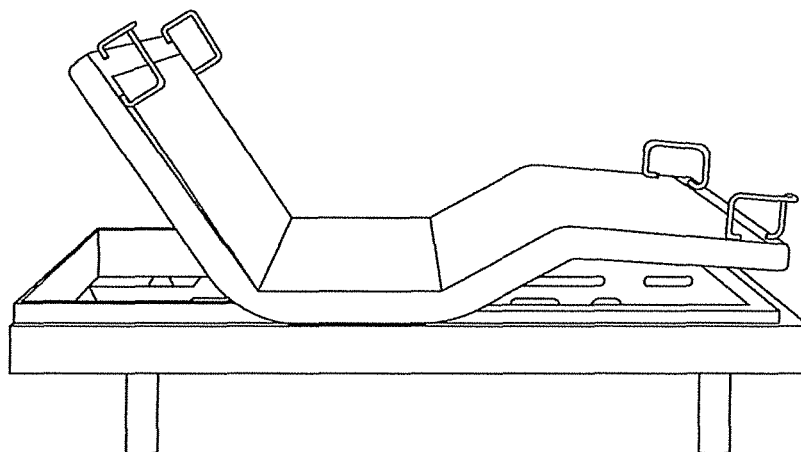


FIG. 43B

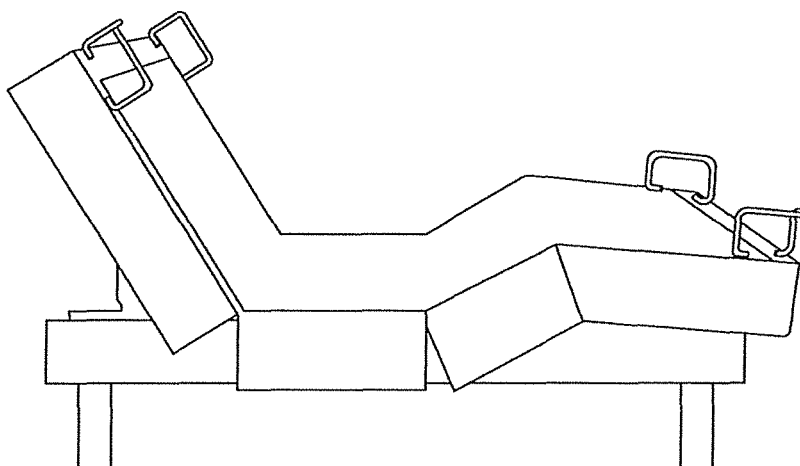
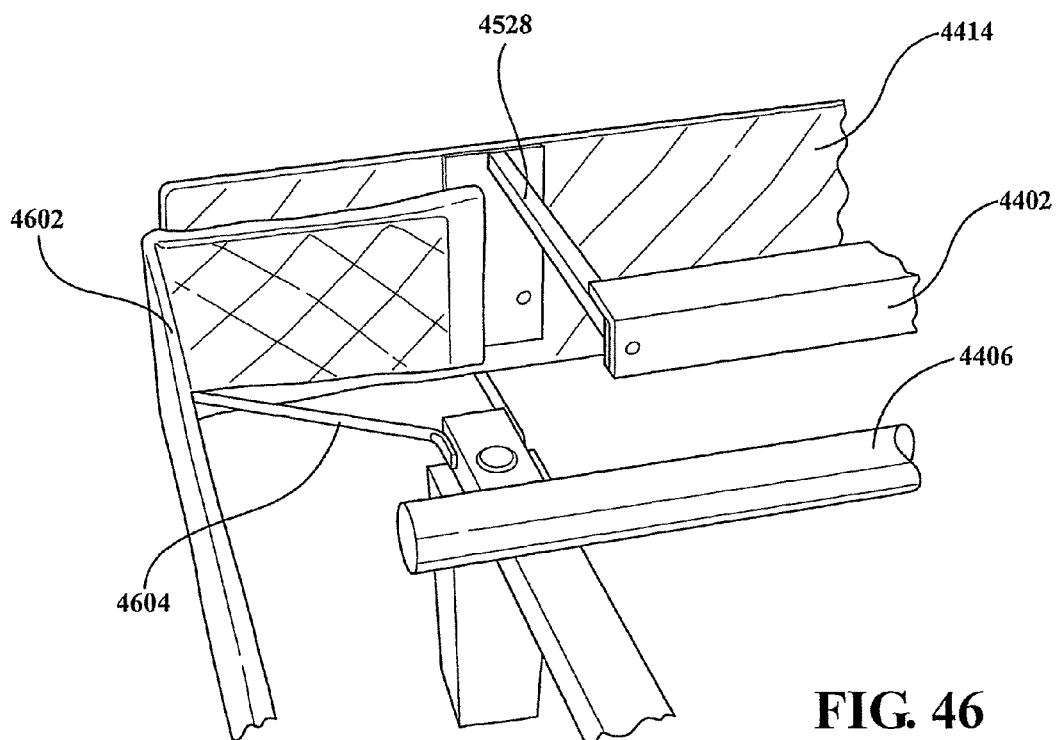
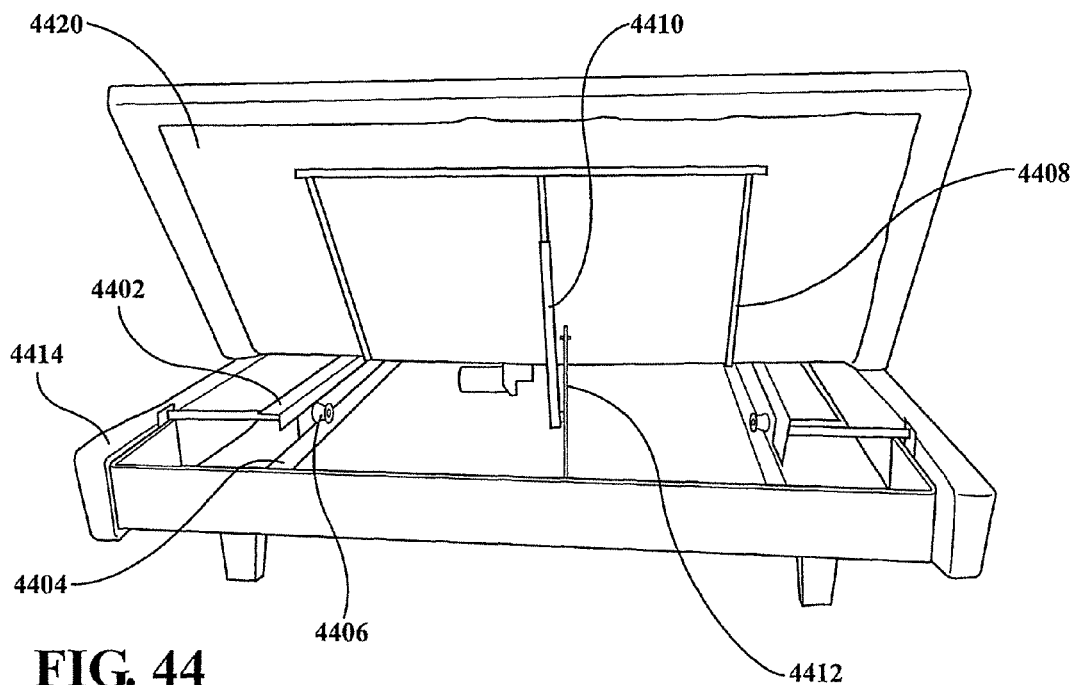
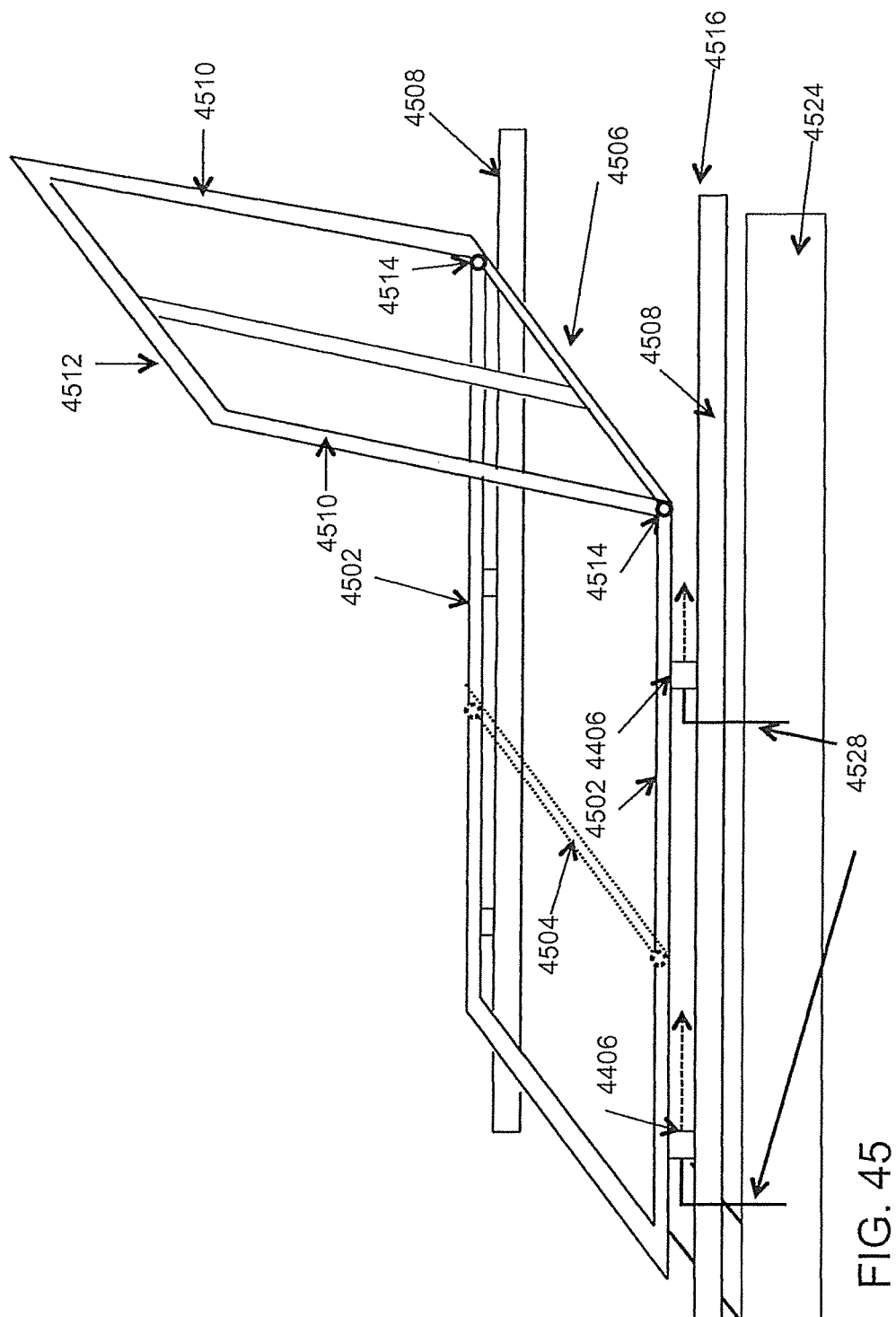


FIG. 43C





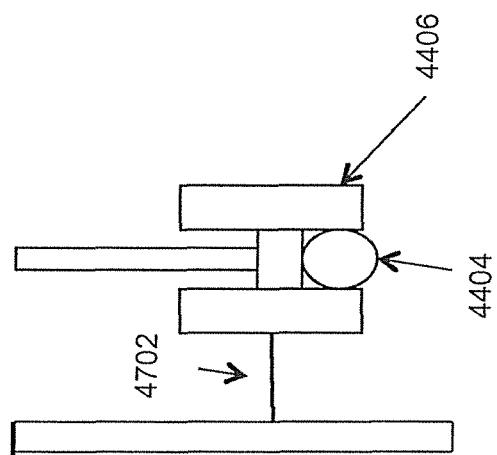


FIG. 47

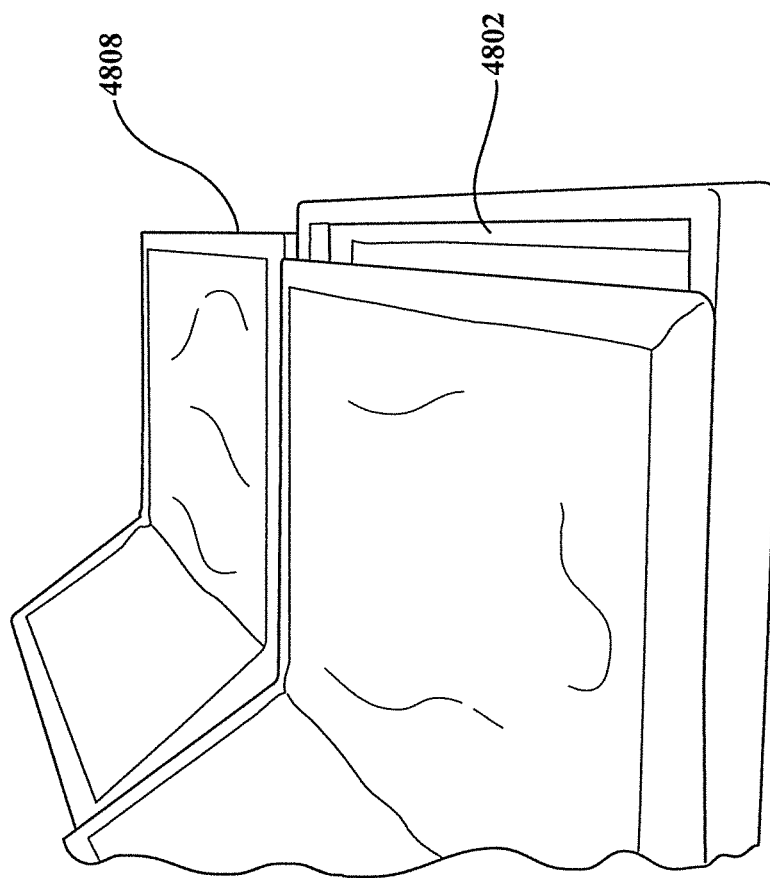
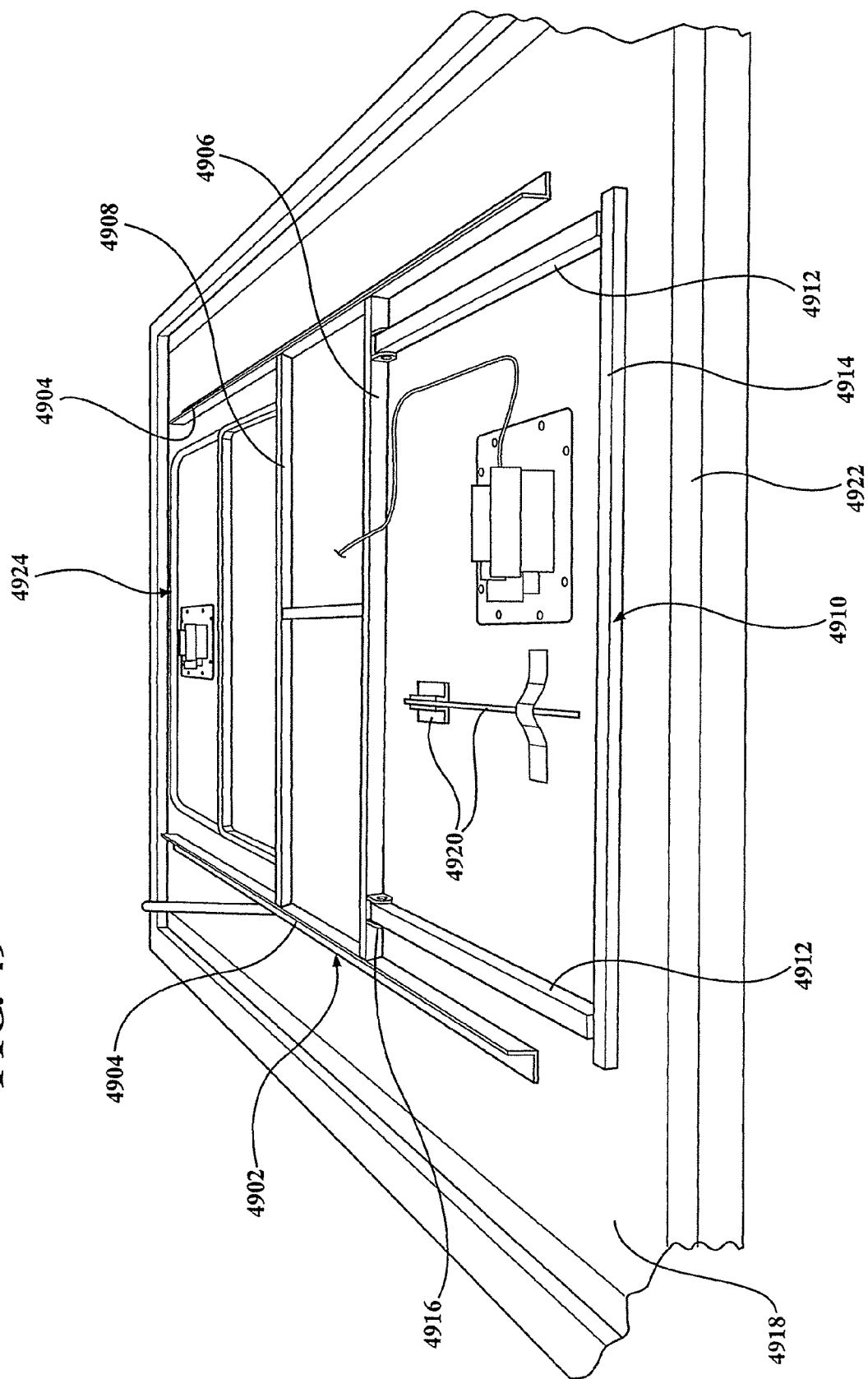


FIG. 48

FIG. 49



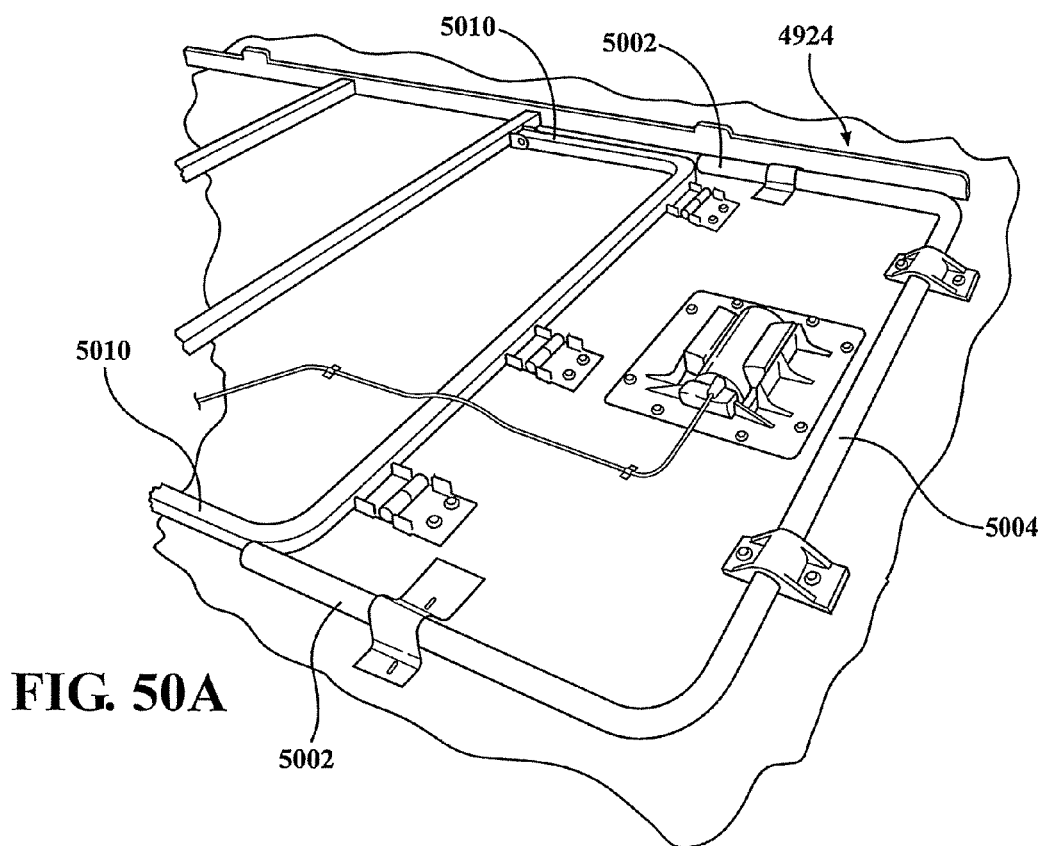


FIG. 50A

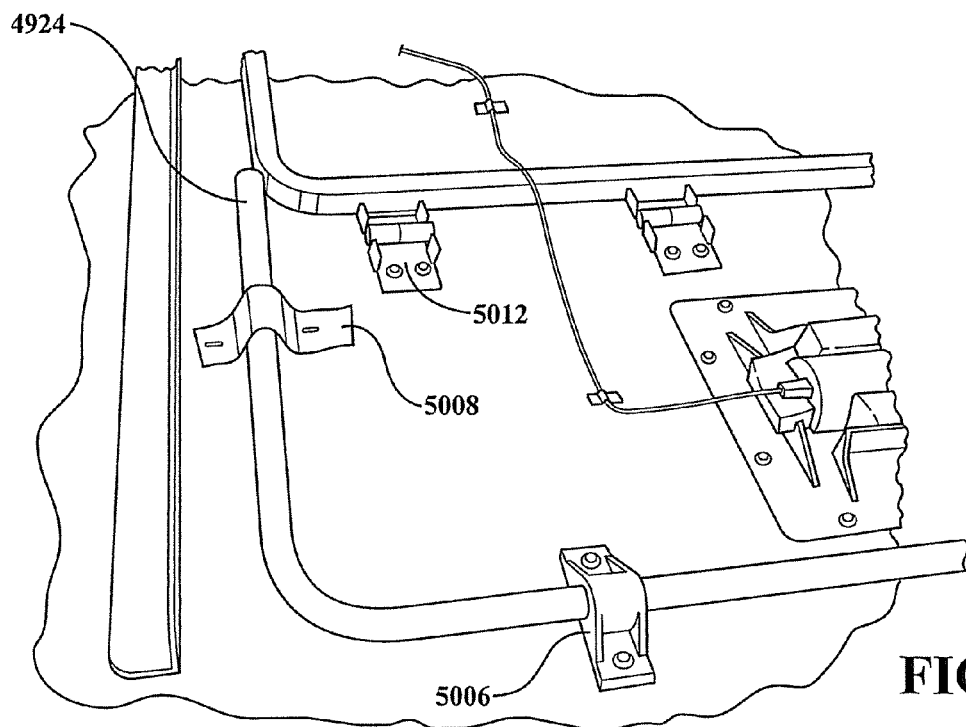


FIG. 50B

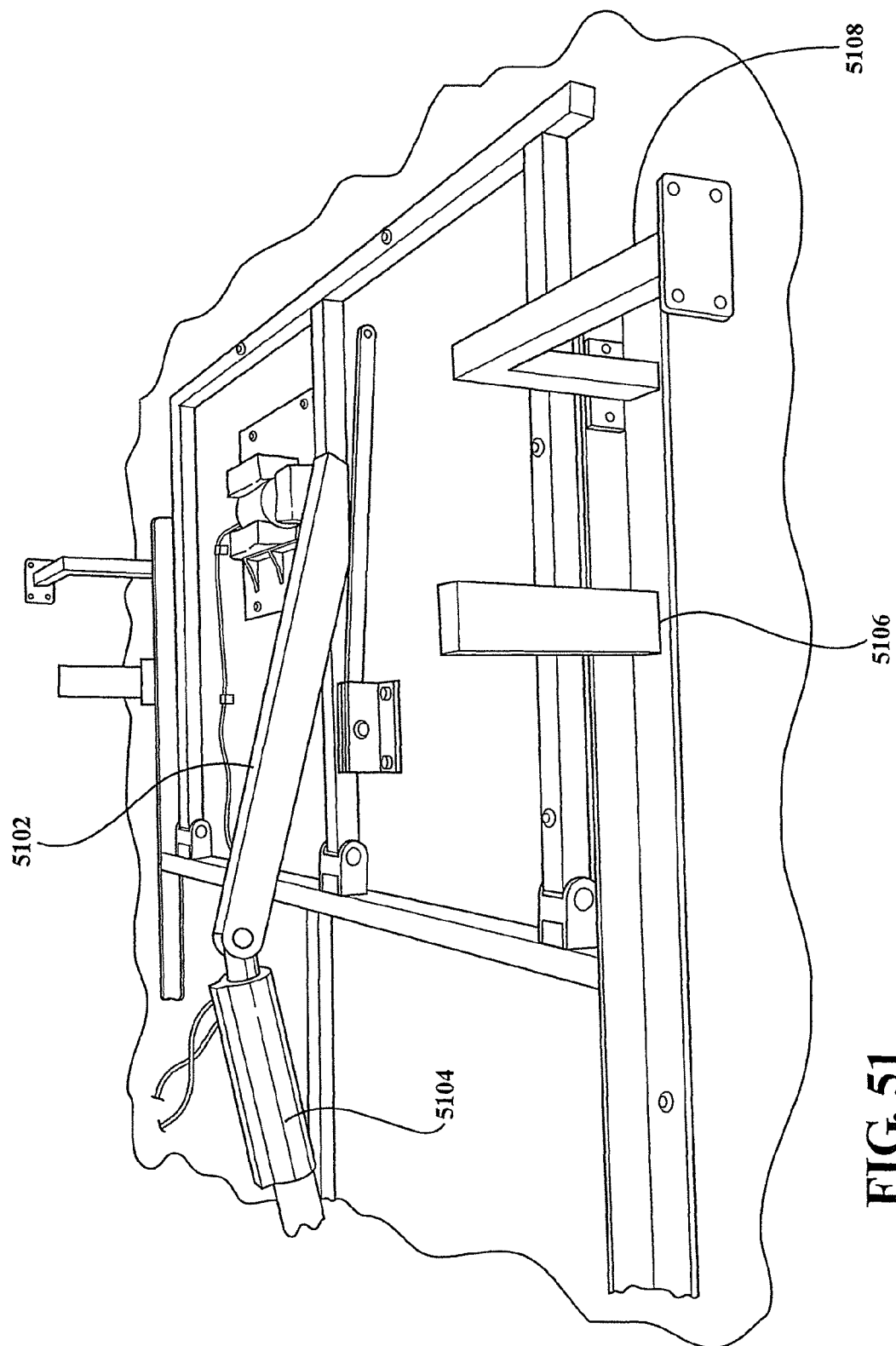


FIG. 51

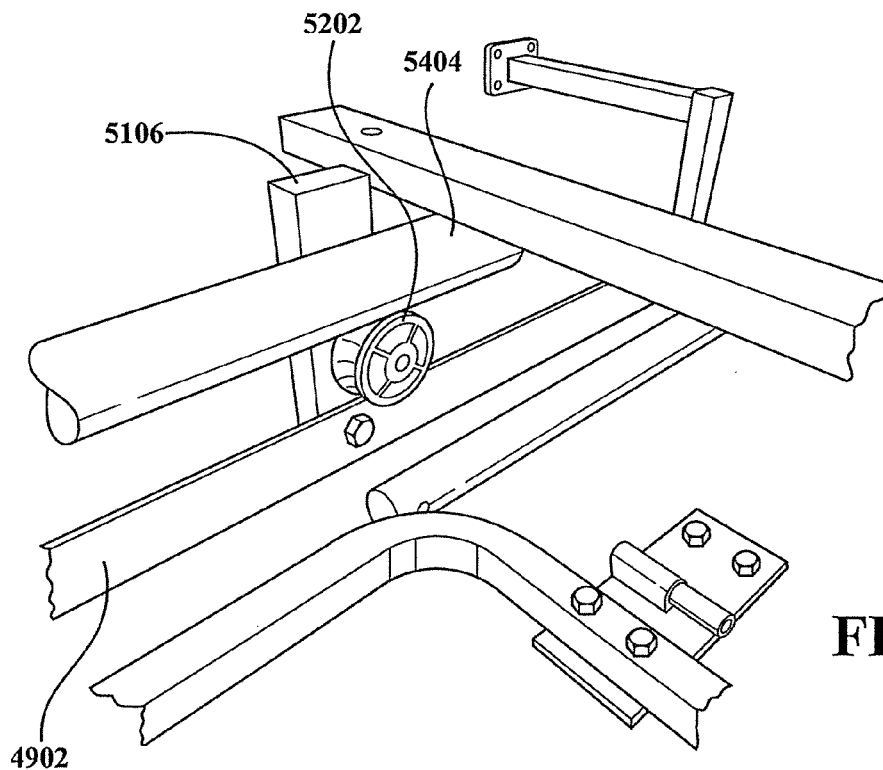


FIG. 52A

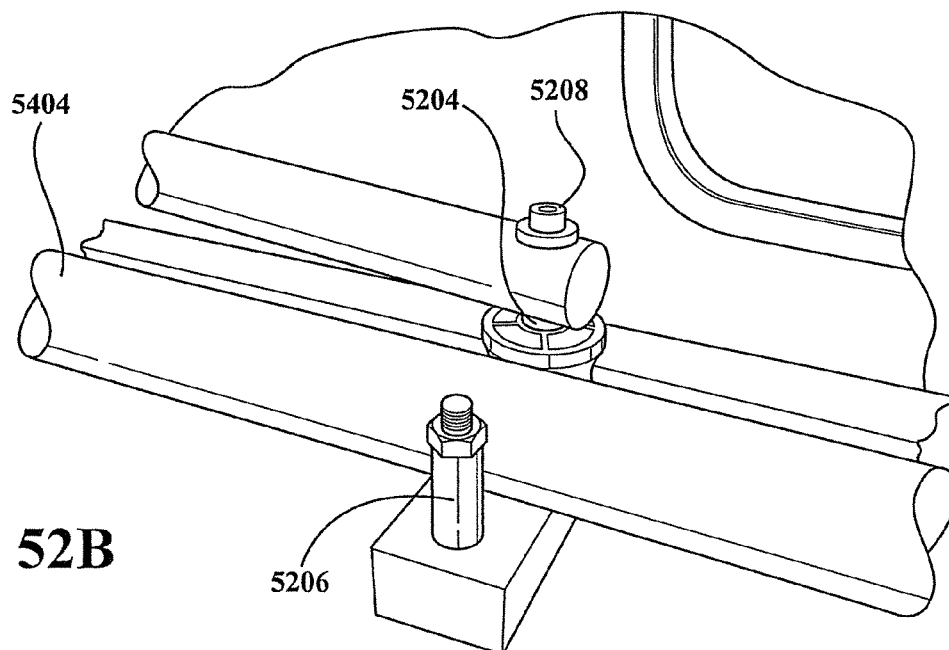
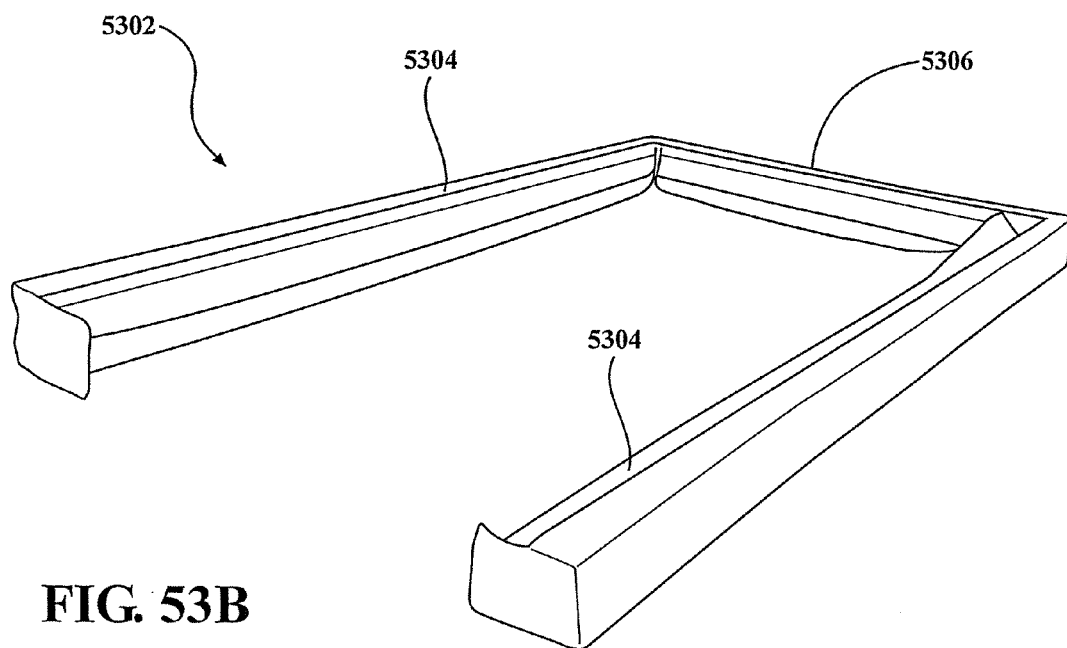
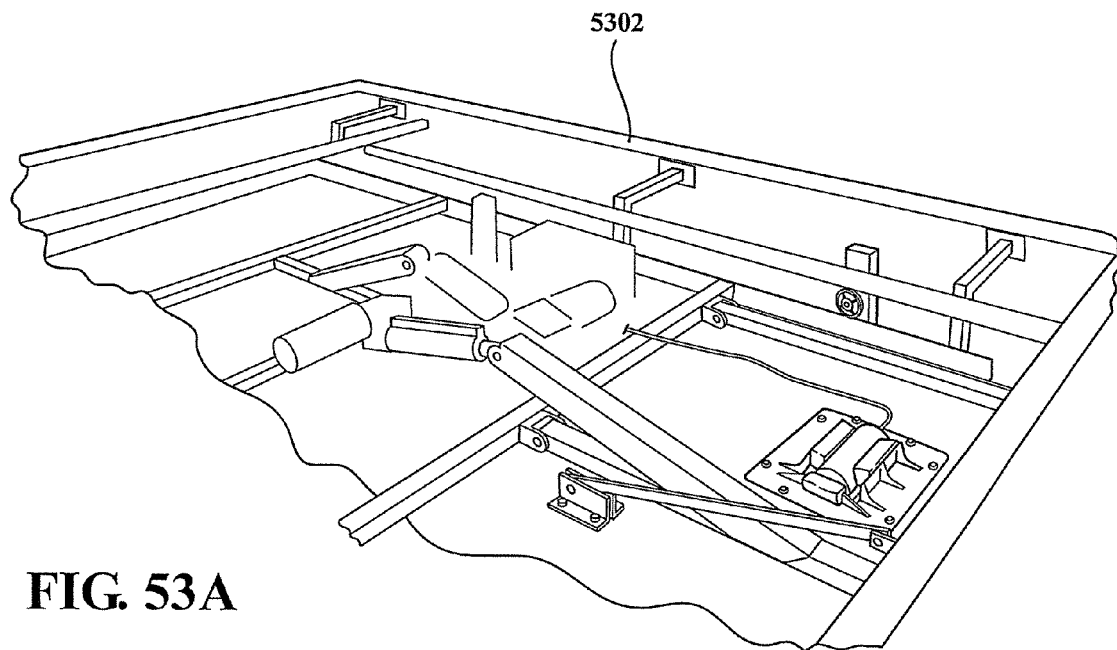


FIG. 52B



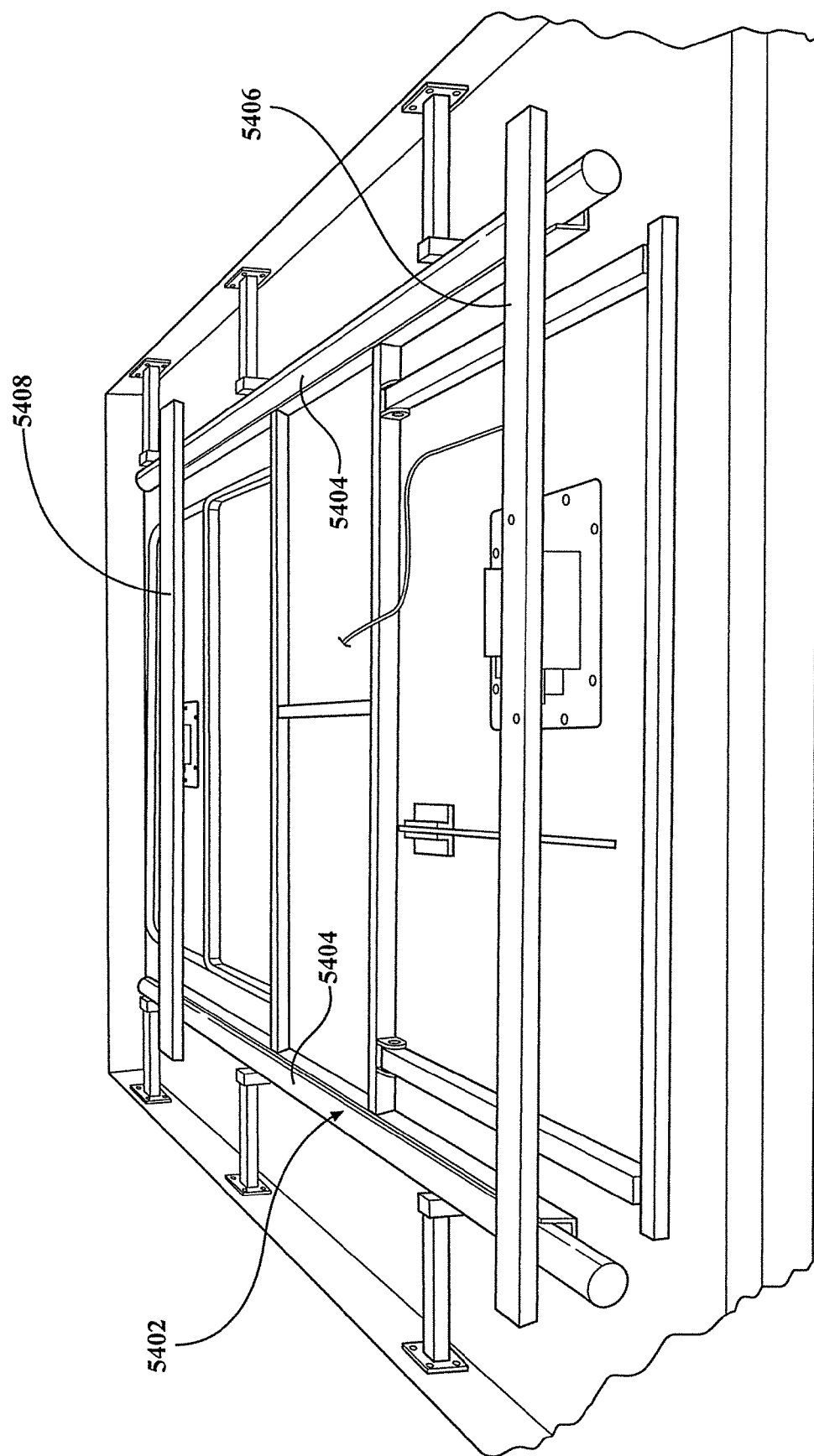


FIG. 54

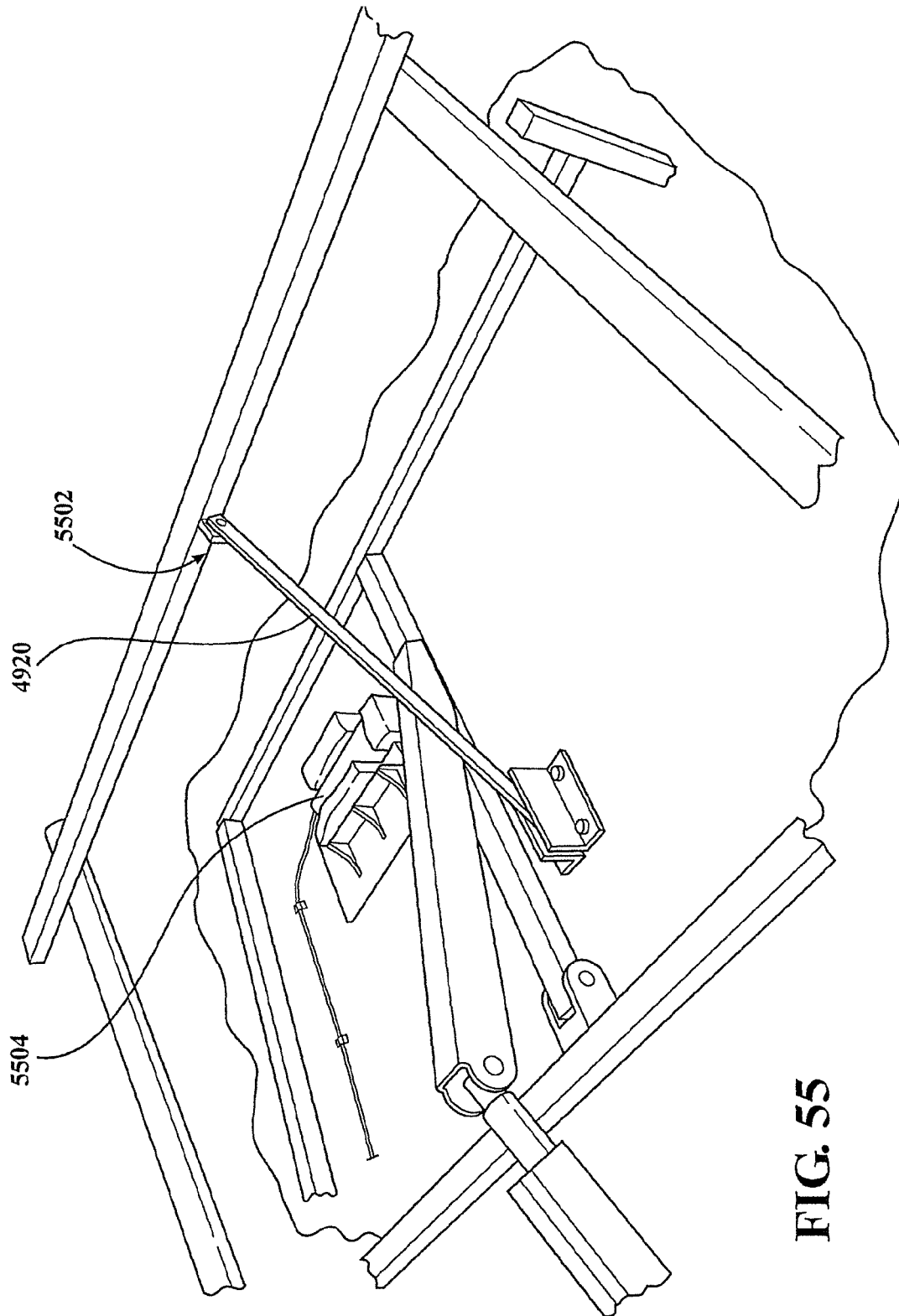


FIG. 55

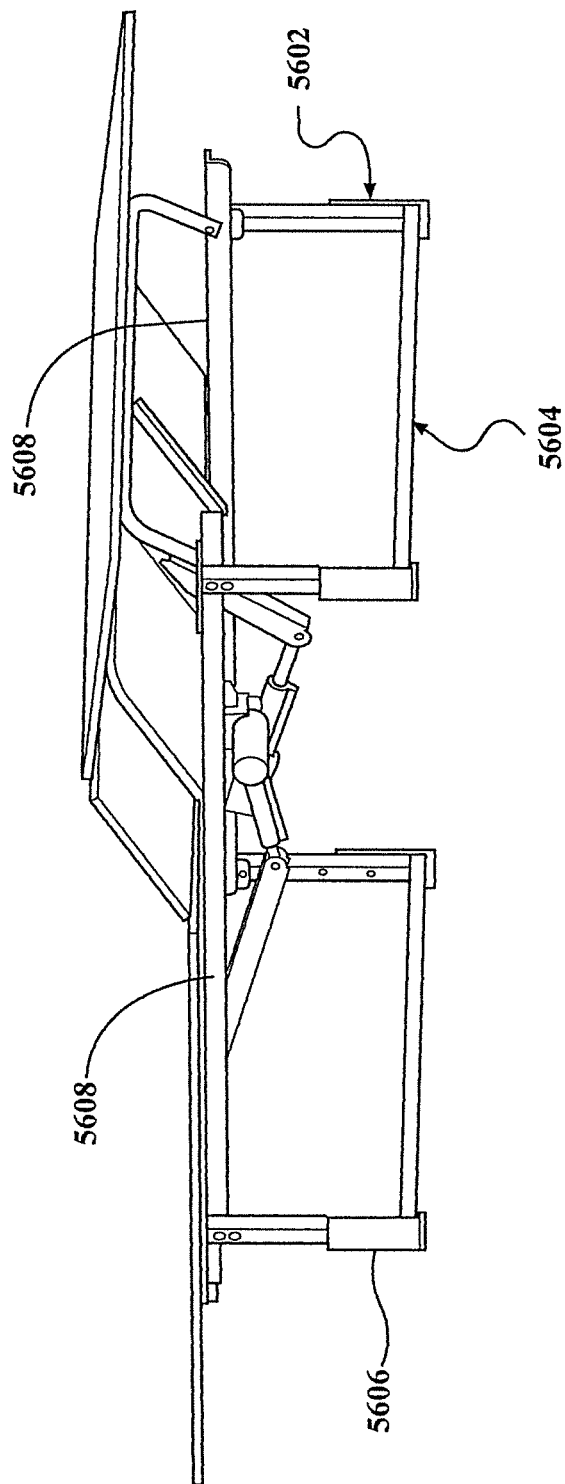
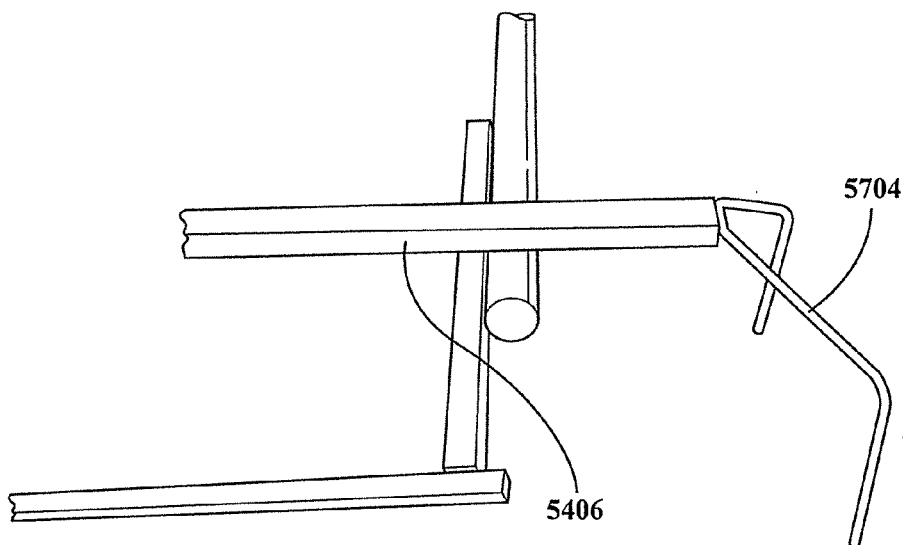
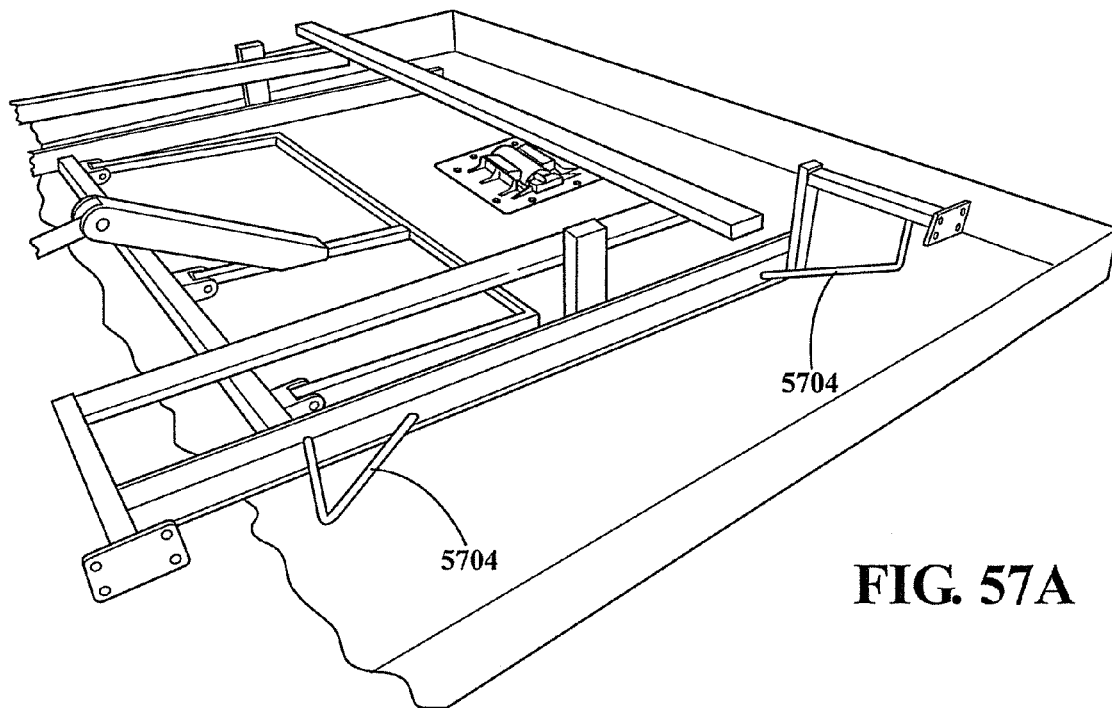


FIG. 56



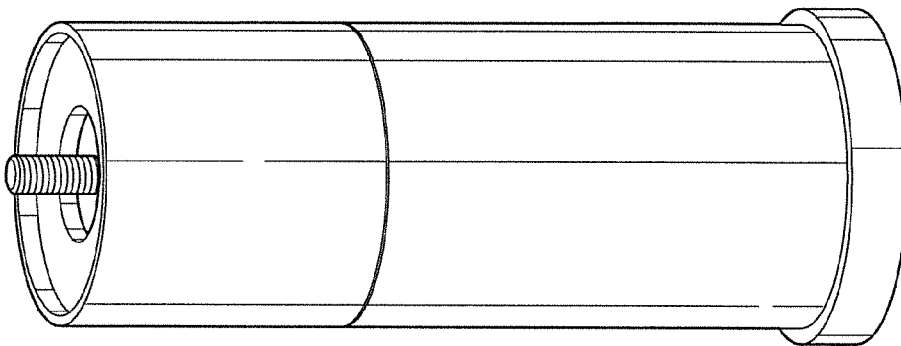


FIG. 58A

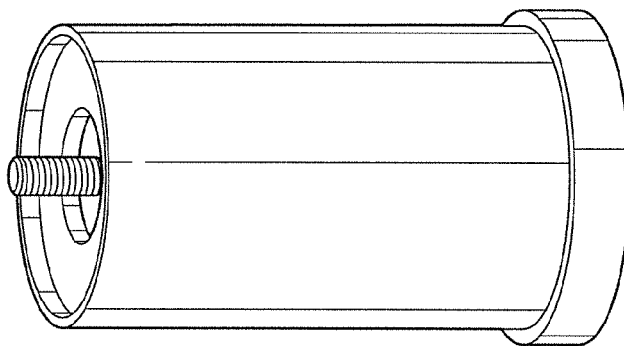


FIG. 58B

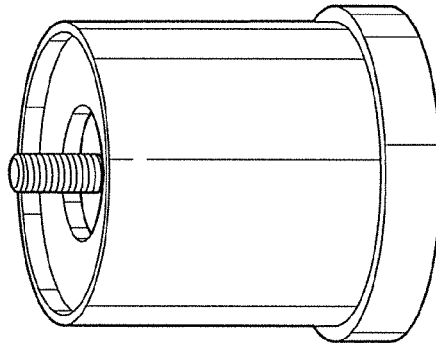


FIG. 58C

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LEG ASSEMBLY FOR A SUPPORT FRAME**CROSS-REFERENCE TO RELATED APPLICATIONS**

This Application is a continuation of U.S. patent application Ser. No. 13/830,796 filed on Mar. 14, 2013. U.S. patent application Ser. No. 13/830,796 is a continuation-in-part of U.S. patent application Ser. No. 13/750,934 filed on Jan. 25, 2013. U.S. patent application Ser. No. 13/750,934 claims the benefit of U.S. Provisional Application No. 61/648,985 filed on May 18, 2012. U.S. patent application Ser. No. 13/750,934 is a continuation-in-part of U.S. patent application Ser. No. 12/702,405 filed on Feb. 9, 2010. U.S. patent application Ser. No. 12/702,405 claims the benefit of U.S. Provisional Application No. 61/170,187 filed on Apr. 17, 2009. U.S. patent application Ser. No. 12/702,405 claims the benefit of U.S. Provisional Application No. 61/150,910 filed on Feb. 9, 2009. The contents of each of which are incorporated herein in their entirety.

BACKGROUND**1. Field**

This invention relates to an adjustable bed frame, in particular an adjustable bed frame providing a deck-on-deck functionality.

2. Background

Adjustable beds are available in a number of configurations. There exists a need for a concealing assembly for adjustable beds to satisfy end user customers.

SUMMARY

In an aspect of the invention, an embodiment of the present invention can be described as a support system, having a support frame and at least one modular leg assembly mounted to and supporting the support frame. The leg assembly includes a first leg member having a body portion with a top end and an opposite bottom end, the body portion having a first top-to-bottom length. The leg assembly also includes a second leg member having a body portion with a top end and an opposite bottom end. The body portion of the second leg member has a second top-to-bottom length that is greater than the first top-to-bottom length. The first and second leg member are connected individually or in combination to the support frame such that at least three leg heights are selectably provided.

In some versions, the first and second leg members each have a connecting element extending therefrom for connecting the leg member to another leg member or to the support frame. The connecting elements may be threaded elements.

In some versions, the support frame includes a base frame and an articulating frame supported by the base frame, and the leg members are connectable to the base frame.

In some versions, the support frame is a mattress support frame.

In some versions, the at least one modular leg assembly may be a plurality of modular leg assemblies.

A further embodiment of the present invention can be described as a bed foundation, having a mattress support frame with a base frame and an articulating frame supported on the base frame, and a plurality of modular leg assemblies. Each leg assembly includes a first threaded member having a body portion with a threaded element extending from a top end. The body portion having a first top-to-bottom length. Each leg assembly also includes a second threaded member

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having a body portion with threaded element extending from a top end. The body portion has second top-to-bottom length, which is greater than the first top-to-bottom length. A plurality of the first threaded members are each connected to the base frame to provide a first leg length for the adjustable bed foundation. A plurality of the second threaded members are each connected to the base frame to provide a second leg length for the adjustable bed foundation. A plurality of threaded together first and second threaded members are connected to the base frame to provide a third leg length greater than the first or second leg length.

A further embodiment of the present invention can be describe as a modular leg kit for a bed foundation having a base frame. The modular leg kit includes a plurality of first leg members each having a body portion with a top end and an opposite bottom end. Each body portion has a first top-to-bottom length. The modular leg kit also includes a plurality of second leg members each having a body portion with a top end and an opposite bottom end. Each body portion has second top-to-bottom length, which is greater than the first top-to-bottom length. The plurality of the first leg members are each connected to the base frame to provide a first leg length for the bed foundation. The plurality of the second leg members are each connected to the base frame to provide a second leg length for the bed foundation. A plurality of connected together first and second leg members are connected to the base frame to provide a third leg length greater than the first or second leg length.

In some versions, each of the first and second leg members have a connecting element extending therefrom for connecting the leg members to another leg member or to the base frame. The connecting element may be threaded elements.

BRIEF DESCRIPTION OF FIGURES

The systems and methods described herein may be understood by reference to the following figures:

FIG. 1 shows a block diagram of an adjustable bed facility and associated components.

FIG. 2 shows an embodiment of two methods of maintaining user memory for storing user preferred adjustable bed positions.

FIG. 3 shows an embodiment of a remote control used to command the adjustable bed facility.

FIG. 4A shows an embodiment of the shipping of a mattress retainer bracket in the upside down position.

FIG. 4B shows an embodiment of the shipping of a mattress retainer bracket in the upside down position.

FIG. 5A shows a top view of a vibration motor within an opening of an adjustable bed facility section lateral surface.

FIG. 5B shows a side view of a vibration motor within an opening of an adjustable bed facility lateral surface.

FIG. 6 shows a typical hospital adjustable bed.

FIG. 7 shows one use of actuators connected to the bed frame and the adjustable sections.

FIG. 8 shows more than one actuator for each adjustable bed section, in this case there are two actuators for each adjustable section.

FIG. 9 shows an adjustable bed using slats instead of wood decking for the foundation of the adjustable sections.

FIGS. 10A, 10B, and 10C show an adjustable bed facility according to an embodiment of the present invention.

FIG. 11 shows operation of an adjustable bed facility according to an embodiment of the present invention.

FIG. 12 shows a hinge joint between the frames/sections of an adjustable bed facility.

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FIG. 13A shows a gusset from an angled view in accordance with an embodiment of the present invention.

FIG. 13B shows a gusset from a side view in accordance with an embodiment of the present invention.

FIG. 14 shows mounting of a control box, a receiver, and a power supply on an adjustable bed facility according to an embodiment of the present invention.

FIG. 15 shows an adjustable bed frame perspective assembly view.

FIGS. 16A, 16B, 16C, 16D, and 16E show various views of an adjustable bed incorporating frame concepts from the frame of FIG. 15.

FIGS. 17A, 17B, 17C, 17D, 17E, and 17F show various views of an adjustable bed incorporating frame concepts from the frame of FIG. 15 with separated mattress support panels.

FIGS. 18A, 18B, 18C, 18D, 18E, and 18F show the bed of FIGS. 17A-F in a horizontal position.

FIGS. 19A, 19B, 19C, 19D, 19E, and 19F show the bed of FIG. 17 with skirt panels.

FIG. 20 shows a detail of a drive bracket assembly.

FIG. 21 shows various rotated positions of the drive bracket assembly of FIG. 20.

FIG. 22 shows an alternate embodiment of an adjustable bed frame that incorporates many elements from FIGS. 15-21.

FIG. 23A depicts the adjustable bed facility supporting a weight on the head board and FIG. 23B depicts the adjustable bed facility supporting a weight on the head board and bed deck.

FIG. 24 depicts the truss structure of the adjustable bed facility.

FIG. 25 depicts the steel skeleton of the adjustable bed facility.

FIG. 26 depicts an alternate view of the steel skeleton of the adjustable bed facility.

FIGS. 27A and 27B depict a covered adjustable bed facility in the A) fully extended and B) head board lifted positions.

FIG. 28 depicts a covered adjustable bed facility in the head board lifted position.

FIG. 29 depicts a view of the truss down the length of the adjustable bed frame.

FIG. 30 depicts a view of the truss down the width of the adjustable bed frame.

FIG. 31 depicts a view of the truss down the width of the adjustable bed frame.

FIG. 32A, FIG. 32B, and FIG. 32C depict different structural views of the adjustable bed facility in accordance with an embodiment of the present invention.

FIG. 32D and FIG. 32E depict the different structural views of the truss of the adjustable bed facility in accordance with an embodiment of the present invention.

FIG. 32F depicts a side view of the adjustable bed facility in accordance with an embodiment of the present invention.

FIG. 32G depicts a top view of the adjustable bed facility in accordance with an embodiment of the present invention.

FIG. 33 depicts a motor connection.

FIG. 34 depicts the connections to a head board of the bed assembly.

FIG. 35A depicts a side view of the bed with the support tube.

FIG. 35B depicts an underside view of the bed with the support tube.

FIG. 35C depicts a top view of the bed with the support tube.

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FIG. 36 depicts an exploded view of the bed with support tube.

FIG. 37 depicts an underside view of the bed assembly with support tube.

FIG. 38A depicts a side view of the support tube.

FIG. 38B depicts a top view of the support tube.

FIG. 38C depicts an alternate view of the support tube.

FIG. 39 depicts an underside view of the bed assembly with support tube.

FIG. 40A depicts an adjustable bed facility with four retainer bars.

FIG. 40B depicts an adjustable bed facility with a mattress held by four retainer bars.

FIG. 41A depicts a drive arm for the adjustable bed facility.

FIG. 41B depicts the underside of the adjustable bed facility.

FIG. 42 depicts an inner fabric skirt for the base frame.

FIG. 43A-FIG. 43C depict different embodiments of a side rail design.

FIG. 44 depicts the underside of an articulating bed.

FIG. 45 depicts a model of an articulating bed.

FIG. 46 depicts a concealing assembly for an articulating bed.

FIG. 47 depicts a view of a concealing assembly attachment to an articulating bed.

FIG. 48 depicts a comparison of a bed with a concealing assembly to one without.

FIG. 49 depicts a portion of a kit for an articulating bed.

FIG. 50A and FIG. 50B depict a portion of a kit for an articulating bed.

FIG. 51 depicts a portion of a kit for an articulating bed.

FIG. 52 depicts a portion of a kit for an articulating bed.

FIG. 53 depicts a portion of a kit for an articulating bed.

FIG. 54 depicts a portion of a kit for an articulating bed.

FIG. 55 depicts a portion of a kit for an articulating bed.

FIG. 56 depicts a model for a non-wallhugger articulating bed.

FIG. 57 depicts a portion of a kit for an articulating bed.

FIG. 58A, FIG. 58B, and FIG. 58C each show an embodiment of a threaded leg member.

DETAILED DESCRIPTION OF FIGURES

In the following description, terms such as 'adjustable mattress', 'adjustable bed', 'adjustable bed facility', 'adjustable bed apparatus', and the like are used interchangeably to refer generally to an apparatus including a sleeping or resting surface with one or more adjustable or moveable sub-surfaces that can be positioned for user comfort and/or convenience, unless a specific meaning is explicitly provided or otherwise clear from the context.

As users spend more and more time in adjustable beds they may desire to have a level of independence by controlling devices that may be in the room from the adjustable bed. The devices and facilities that users may wish to control may include audio equipment, video equipment, lamps, air purification facilities, power outlets, and the like. It may be desirable for the user to control these devices and facilities from the adjustable bed without having to leave the bed or ask for aid from someone else. For example, the user may be confined to the bed and may want the simple ability to control the lights around the adjustable bed.

In an embodiment, an adjustable bed may not be the only rest facility to benefit from position and additional function control. Users may also use beds, adjustable beds, adjustable chairs, adjustable couches, and the like to provide comfort-

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able positions when the user may have limited mobility. For example, a user that has had hip replacement surgery may not be confined to bed but may require a chair or couch to be adjustable to provide a comfortable sitting position while providing control of other devices within the room to limit the number of times the user must get up and adjust the devices. In an embodiment, while recovering from a surgery, an injury, an illness, or the like, the user may use more than one type of rest facility. The user may require confinement to an adjustable bed for a time and then, with health improvement, be able to move to either an adjustable chair or adjustable couch.

Aspects of the invention may be described as an adjustable bed, but it may be understood that the same aspects may be applied to other rest facilities that may include a bed, a couch, a chair, or the like. Such rest facilities may be in a home, a car, a recreational vehicle, a cruise ship, an airline, a train, or anywhere that a user required them, and they may be fixed or mobile.

One aspect of this invention may be to provide the adjustable bed with more than one power option to move the adjustable bed sections. The adjustable bed may use electric motors with gearboxes, pneumatic springs, hydraulic springs, or the like to actuate the adjustable bed sections. There may be both pricing and durability reasons to have the different actuation types.

Another aspect of this invention may be to provide the ability to provide additional functionality to the adjustable bed by using modular controls that may be able to communicate with the user's interface control. The modular controls may be designed to control a number of additional devices and facilities that may include audio devices, video devices, lamps, air purification facilities, power outlets, and the like.

Another aspect of the adjustable bed may be to provide a support structure to support the bed materials (e.g. mattress), motors, actuators, hinges between bed sections, and the like. The support structure may be a frame structure to provide the support yet remain lightweight.

Another aspect may be the use of replaceable memory to maintain the bed memory and software applications. The replaceable memory may allow user specific information to be moved from one adjustable bed to another adjustable bed. This may be useful in care facilities where a user may move from one bed to another bed during the stay in the care facility. If the user has saved a preferred positioning of the adjustable bed, when the user moves to another bed, the preferred positioning settings may be moved to the other bed with the user.

Another aspect of the adjustable bed may be to provide safety features that may control the retraction of the adjustable bed sections to reduce the risk of crushing an object that may be under the adjustable bed.

Now referring to FIG. 1, a block diagram of the various components of the adjustable bed facility 102 is shown. In an embodiment, an adjustable bed facility 102 may be made up of a number of devices and facilities that may include actuators 104, springs 108, mattresses 110, a sub-frame 112, a skeleton structure 114, vibration motors 118, supports 120, safety brackets 122, an electronic facility 124, an air purification facility 144, a remote 148, a memory facility 150, a memory connection 160, a network connection 162, and the like. In an embodiment, the electronic facility 124 may include a wire harness 128, a receiver 130, modular controls 132, a control box 134, power outlets 138, a power connection 142, and the like. In an embodiment, the memory facility 150 may include a receiver learn facility 152, bed

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memory 154, a backup battery 158, and the like. In an embodiment, the receiver learn facility 152, bed memory 154, and backup battery 158 may not be part of the memory facility 150, but may be combined into other facilities or devices, be stand-alone devices, or the like.

In an embodiment, the physical aspects of the adjustable bed facility 102 that provide support for the user may include the actuators 104, springs 108, mattresses 110, a sub-frame 112, a skeleton structure 114, vibration motors 118, supports 120, and safety brackets 122.

In an embodiment, the skeleton structure 114 may provide the central structure that the other physical aspects may interact with. In an embodiment, the skeleton structure 114 may provide direct support to the mattress 110, springs 108, and the like. In an embodiment, the skeleton structure 114 may be a lightweight frame structure that may provide both the strength and rigidity required to properly support the mattress 110 and springs 108. In embodiments, the skeleton structure 114 may use materials that include metal, plastic, wood, or the like; the materials may be used individually or in combination. In an embodiment, the skeleton structure 114 may include more than one section/frame. The sections/frames may be fixed or may be adjustable/movable. Further, the sections/frames may be assembled together to form the skeleton structure 114 in such a way that the sections/frames may be able to move relative to each other to provide the various bed positions required by the user.

In an embodiment, springs 108 may be used with a mattress 110, instead of a mattress 110, or the like. In an embodiment, the springs may be a standard bed spring system (e.g. coils within a wire framework), individual coil springs, individual foam springs, air springs, or the like. In an embodiment, the individual springs (e.g. coil, foam, or air) may be used to provide variable firmness to provide comfort to the user. For example, the springs 108 may be less firm or firmer in a local area to provide the user with the support that may be required for a body location that is experiencing discomfort (e.g. a hip, shoulder, back, neck). Springs that may have local firmnesses will be described in more detail below.

In an embodiment, the mattress 110 may include foam, feathers, springs 108, material, or the like. In an embodiment, the different materials may be used individually or in combination. The mattress may be intended to provide the user with a firmness that provides for the comfort requirements of the user.

In an embodiment, the mattress 110 may be an air mattress 110. In an embodiment, the air mattress 110 may be constructed using a single chamber, a plurality of chambers, a plurality of individual chambers, a combination of chamber shapes, or the like. In an embodiment, the air mattress 110 may be inflated to various pressures that may provide the user with the desired comfort level. In an embodiment, there may be separate air mattresses 110 for each of the adjustable bed facility 102 sections. For example, there may be separate air mattresses 110 for the head, torso, and foot sections of the adjustable bed facility 102. In an embodiment, the inflation pressure of the individual air mattresses 110 may be different from each other depending on user settings.

In an embodiment, the adjustable bed facility 102 sections may each contain individual air mattresses 110. For example, the head, torso, and foot sections may each have individual air mattresses that may be individually controlled for air pressures and therefore firmness. In an embodiment, the user may be able to control the firmness of the individual air mattresses 110 using a remote 148. In an embodiment,

the remote **148** may have indicators for each of the firmness adjustable air mattresses **110**. For example, the remote **148** may have keys for increasing or decreasing the pressures of the individual air mattresses **148**. Using the remote **148**, the user may be able to adjust the firmness of the adjustable bed facility sections.

In an embodiment, the air mattress **110** may use a common air supply source facility as an air actuator **104**. In an embodiment, a control box **134** may control both the air mattress **110** and air actuator **104**. The control box **134** may provide controlling commands to both the air mattress **110** and air actuators.

In an embodiment, the skeleton structure **114** may have structural members that support the mattress **110** and springs **108** and may also provide support and connections for the actuators **104**, sub-frame **112**, supports **120**, vibrator motors **118**, safety bracket **122**, and the like. In an embodiment, the structural members may be positioned on the peripheral edges of the mattress **110** and springs **108** to provide overall support and rigidity to the mattress **110** and springs **108** and may form the base of the individual adjustable bed facility **102** sections. Additionally, there may be other structural members as support, cross pieces, or the like that may provide additional support to the mattress **110** and springs **108** as may be required. A person knowledgeable in the art may understand that the frame structure may have many different construction configurations to provide support and rigidity to the mattress **110** and springs **108**.

In an embodiment, the skeleton structure **114** may include more than one section/frame. The sections/frames may be fixed or may be adjustable or movable. Further, the sections/frames may be assembled together to form the skeleton structure **114** in such a way that the sections/frames may be able to move relative to each other to provide the various bed positions required by the user. To achieve this, the sections/frames may be connected together using hinges or like devices that allow a freedom of motion between them.

In one embodiment, one frame/section may remain fixed and may act as the foundation for the other movable frames/sections. For example, in an arrangement as shown in FIGS. **10A** and **10B**, the skeleton structure **114** may have a fixed center frame **1002** and adjustable frames for the head **1004**, foot **1008**, and leg **1010**. In this arrangement, the adjustable head frame **1004** and the adjustable leg frame **1010** may be pivotally attached to the center frame **1002**. The pivot attachments may enable rotational movement of the head frame **1004** and the leg frame **1010** with respect to the fixed center frame **1002**. In a scenario, because of this rotational movement, the head frame **1004** may be raised with the help of the actuators **104** to raise the upper portion of a patient body during meals. Further, the head frame **1004** may be lowered to the normal level after the patient has had his/her meal. In a similar fashion, a person lying on the adjustable bed **102** may raise or lower the head frame **1004** and/or the foot frame **1008** to his/her convenience. FIG. **10C** shows an example top view of one embodiment.

In another embodiment, any or none of the frames/sections may be a fixed foundation section in the adjustable bed facility **102**. In embodiments, there may be more than one adjustable bed facility **102** configuration depending on the requirements of a user, cost requirements, medical needs, or the like. For example, there may be a configuration where only the head section is adjustable to provide the user with the ability to have an elevated upper body position. This configuration may be a single purpose bed but may also provide the user with a less expensive adjustable bed facility **102** that meets the user's needs. One skilled in the art may

understand that there may be many different adjustable bed facility configurations containing fixed and moveable sections.

In embodiments, there may be different combinations of movable and fixed sections with one or all of the sections being movable. In an embodiment, the sections may include the skeleton structure **114**, mattress **110**, springs **108**, and the like and may individually be small mattress structures of the entire adjustable bed facility **102** mattress.

In embodiments, the frames may be made of square tubular steel bars/pipes or any other material capable of providing required strength to the frames. In preferred embodiments, each frame may include two substantially parallel side frame members connected by one or more connector frame members. In order to connect the parallel side frame members, various joining methods such as welding, brazing, riveting, fastening with nuts, and the like can be used. For example, the center frame **1002** may include two substantially parallel side frame members **1012** connected by two substantially parallel connector frame members **1014** and **1018**. The two connector frame members **1014** and **1018** may be located within approximately a center one-third of the length of the side frame members **1012**. Once the frame members have been connected to each other using any one of the joining methods as discussed above, the center frame **1002** may take a substantially square or rectangular shape. Those skilled in the art would appreciate that the frames may have various other shapes and designs to perform the same functionality and without deviating from the scope of the invention.

In an embodiment, the skeleton structure **114**, as part of each adjustable bed facility **102** frame/section, may also provide support and connection members for the components that may be used to move the various adjustable bed facility **102** sections. There may be skeleton structure **114** members that provide connection support to the actuators **104**, supports **120**, safety brackets **122**, vibration motors **118**, and the like. These support and connection members may have any shape or configuration required to provide the support and connections needed by the various other components. For example, in addition to the skeleton structure **114** that is used to provide support to the mattress **110** and springs **108** there may be at least one cross member that may provide a connection to the actuator **104** and safety bracket **122**.

In an embodiment, the skeleton structure **114** and the sub-frame **112** may interface with each other; the sub-frame **112** may provide structural support and a rigid foundation base to the skeleton structure **114**. In an arrangement of this embodiment, only one frame of the skeleton structure **114** may be attached with the sub-frame **112**. For example, the center frame **1002** may be rigidly attached to the sub frame **112** in such a manner that the center frame **1002** may not move with respect to the sub frame **112**. The sub-frame **112** may provide a base to solidly connect the center frame **1002** to provide a fixed non-moving section. The other moveable frames such as the head frame **1004** and the foot frame **1008** may be moveably connected to the fixed center frame **1002** and additionally supported by the sub-frame **112** using a moveable interface connection.

In an embodiment, the sub-frame **112** may be the rigid structure that is in contact to the floor and may provide a base for any fixed adjustable bed facility **102** sections and an interface for any movable adjustable bed facility **102** sections. In an embodiment, the sub-frame **112** legs may be connected to the sub-frame **112** using a threaded stud into threads of the sub-frame **112**. In an embodiment, to prevent

the threaded stud from pulling out of the legs during tightening, the head of the threaded stud may be fixed between two or more layers of leg material. This construction may trap the threaded stud head to prevent it from moving away from the end of the leg and may also prevent the threaded stud head from being pulled through the end of the leg during the tightening of the leg to the sub-frame. In addition, the two or more layers of leg material may provide for added strength to the sub-frame 112 legs to prevent distortion at the sub-frame 112 and leg interface.

In an embodiment, the sub-frame 112 may have structural members that may run along the length of the adjustable bed facility 102, run along the width of the adjustable bed facility 102, run diagonally across the adjustable bed facility 102, or other orientation in relation to the adjustable bed facility 102 that may be required for support or connection to components.

In an embodiment, the skeleton structure 114 may be used as an RF antenna for receiving communication from the remote 148. In embodiment, the entire skeleton structure 114 may be used as an antenna; a portion of the skeleton structure 114 may be used as an antenna, or the like.

In one embodiment, the sub-frame 112 may provide solid connections for any fixed section and skeleton structure 114 by rigidly connecting the skeleton structure 114 directly to the sub-frame 112. In this manner, any fixed section and skeleton structure 114 may be rigidly connected to the sub-frame 112, and through the sub-frame 112, rigidly connected to the floor.

In another embodiment, the sub-frame 112 may provide an interface for the fixed adjustable bed facility 102 section and skeleton structure 114 where the fixed section may be able to move or slide in relation to the sub-frame 112. By providing a non-rigid interface connection between the sub-frame 112 and the skeleton structure 114, the fixed adjustable bed facility 102 section may have a freedom of motion but still may be supported by the sub-frame in a solid foundation manner. For example, as shown in FIG. 11, the center frame 1002 may have wheels 1102 that run in a track 1104 and may be able to move horizontally during the motion of one or more of the movable frames. The track 1104 may be in form of a groove, a "C" channel, or the like. Alternatively, the track 1104 may be in the form of a tube and the wheels 1102 may include a concave surface that meets the track 1104, allowing the wheels 110 to run over the track 1104. In embodiments, concave wheels 1102 may wrap partially around the shape of the tubing and ride along it keeping various segments from shifting side to side. The wheel may include a stabilizing member to prevent the wheels from separating from the tubing. The stabilizing member may extend from the wheel along the side of the tubing. The side of the tubing may be the left side, the right side, and the like. The stabilizing member may wrap around the tubing to extend below the tubing to a side of the tubing that is opposite from the wheel. The side of the tubing that is opposite from the wheel may be underneath the tubing. The stabilizing member may extend vertically upward on the opposite side of the wheel. The stabilizing member may be in the shape of an "L", of a "U", and the like. In an embodiment, the horizontal freedom of motion may provide for a "wall hugger" feature where, as the head frame 1004 is adjusted up, the center frame 1002 may move, along with the head frame 1004, horizontally backward and towards an adjacent wall to maintain a fixed distance between the head frame 1004 and the wall, therefore "hugging" the wall. Similarly, when the head frame 1004 is adjusted down, the center frame 1002 may move horizontally forward and away

from the wall to maintain the fixed distance. It may be understood by one skilled in the art that the moveable interface between the skeleton structure 114 and sub-frame 112 may be any type of interface, such as a rack and a pinion arrangement that may allow freedom of motion between the sub-frame 112 and skeleton structure 114.

In an embodiment, any adjustable section/frame may have two connections, a first connection may be provided by a hinge type connection and a second connection may be the connection with the actuator 104 and safety bracket 122 that may provide the force to rotate the adjustable bed facility 102 section up or down. In an embodiment, the hinge type connection between the skeleton structure 114 of a first section and a second section may provide the point of rotation for the section motion. In an embodiment, the adjustable bed facility 102 may contain more than one section and any or all of the sections may be connected by a hinge type connection. For example, as shown in FIG. 12, the head frame 1004 may be connected to the center frame 1002 by two hinge joints. Here, the parallel side frame members of the head frame 1004 may be pivotally connected to a forward connector frame member 1014 of the center frame 1002. The hinged joints between each of the parallel side frame members of the head frame 1004 and the forward connector frame member 1014 may enable the rotational motion between the center frame 1002 and the head frame 1004. In an arrangement of this embodiment, the hinge joints may be reinforced by providing a "U" shaped end bracket 1202 at the end of the parallel side frame members. The "U" shaped end bracket 1202 may be of any thickness that increases the strength of the hinge joint to prevent bending. The thickness of the "U" shaped end bracket 1202 may be determined by the amount of force and torque that may need to be resisted during the movement.

With the adjustable bed facility 102 sections interconnected using hinge type connections there may be at least one actuator 104 that may provide a connection between a fixed adjustable bed facility 102 section and a moveable section. In an embodiment, the hinge connection between the adjustable bed facility 102 sections may be a pivot point bracket that may include additional strengthening to resist bending forces. In an embodiment, the actuation 104 connection may be between two of the skeleton structures 114. For example, a first end of the actuator 104 may be connected to a rear connector frame member 1018 of the center frame 1002 and a second end of the actuator 104 may be connected to the frame that is to be moved (e.g. head frame 1004, leg frame 1010, or foot frame 1008). In an arrangement, as shown in FIG. 13A, a downwardly facing extension frame member/a gusset 1302 may be attached to the head frame 1004 or any other frame to be moved. Further, as shown in FIG. 13B, the actuator 104 may be connected to the head frame 1004 to be moved using the downwardly facing extension frame member.

In an embodiment, as shown in FIG. 13B, there may be the gusset 1302 for connection between the actuator 104 and the adjustable bed facility 102 section/frame. In embodiments, the gusset 1302 may be an I beam, a T beam, an L beam, a box beam, or any other beam design that may provide the strength to lift the combined weight of the adjustable bed facility 102 section and the user without bending. In an embodiment, to resist bending forces at the connections to the actuator 104 and the adjustable bed facility 102 section, the ends of the gusset may be reinforced. In embodiments, the reinforcement may be an additional bracket added to the ends of the gusset, such as a U bracket or other bracket shape, to provide for increased

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material thickness and strength of the gusset ends. The thickness of the additional bracket may be determined by the amount of force and torque that may need to be resisted during the adjustable bed facility 102 section movement.

In an embodiment, the actuator 104 may use electric motors and mechanical gears, pneumatic pressure, hydraulic pressure, pneumatic spring, air spring, hydraulic spring or the like to provide the force to extend and retract the actuator 104. The action of extending and retracting the actuator 104 may move the various movable bed sections up or down. By the actuator 104 pushing against the section, the section may rotate upward around the pivot point provided by the hinge type connection. In the same manner, by the actuator 104 pulling against the section, the section may rotate downward around the pivot point provided by the hinge type connection. In an embodiment, there may be at least one actuator 114 for every moveable adjustable bed facility 102 section.

In an embodiment, the combination of actuator 114, safety bracket 122, and supports 120 may provide a safety feature to prevent an object that may be under the adjustable bed facility 102 from being damaged, impinged, crushed, or the like during the decent of the adjustable bed facility 102 section. During the downward motion of one adjustable bed facility 102 sections, the section may come in contact with an object that is under the adjustable bed facility 102. If the actuator 104 is allowed to continue to pull the section in the downward direction, the object may be crushed under the force the actuator 104 may apply. In an embodiment, the safety bracket 122 may have a slot that may provide time to determine that there is an object under the section that is moving downward.

In an embodiment, the slot may have a first side that is on the opposite side of the slot from the actuator 104 and a second side that is on the same side as the actuator 104. In an embodiment, the slot that is between the first side and the second side may be of any length. In an embodiment, the actuator may push against the first side to move the adjustable bed facility 102 section in an upward direction. In an embodiment, during the downward motion of the section, the actuator 104 may move at the same speed as the adjustable bed facility 102 section and therefore the actuator connection to the safety bracket 122 may remain within the safety bracket 122 slot without contacting either the first or second sides of the slot. In an embodiment, the section may move in the downward direction under the weight of the section without the actuator 104 pulling on the second side of the safety bracket 122.

In an embodiment, the adjustable bed facility 102 section downward speed may be further controlled by supports 120 that may provide resistance to the section motion to control the rate of decent. In an embodiment, the support 120 may be a pressurized device using pneumatic pressure, hydraulic pressure, or the like to provide a resistive force to slow the decent of the adjustable bed facility 102 section. In an embodiment, the supports may provide enough resistance to control the rate of decent of the section as the actuator 104 is retracted.

In an embodiment, as the actuator 104 retracts, the adjustable bed facility 102 section, with the aid of the support 120, may descend at the same rate as the as the actuator 104 is retracting. By matching the rates of the actuator 104 retraction and the adjustable bed facility 102 section descending, the actuator 104 connection within the safety bracket 122 slot may remain within the slot area and not contact either the first or second side of the slot. In an embodiment, as the section descends, if an object is encountered, the adjustable bed facility 102 section may stop its

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decent and the actuator 104 connection will move within the safety bracket 122 slot without pulling the section downward. In an embodiment, the amount of time that the actuator 104 connection is moving within the safety bracket 122 slot while the adjustable bed facility 102 section is stopped may provide time to the user to realize that an object has been contacted and to stop the downward motion of the section.

In an embodiment, an additional safety feature may be the addition of a shut off sensor, shut off switch, or the like on the first side of the safety bracket 122 slot to stop the retraction of the actuator 104 if the actuator 104 connection comes in contact with the first side of the slot. In this manner, if the actuator 104 connection with the safety bracket 122 slot reaches the first side of the slot, the actuator 104 retraction may be stopped and the adjustable bed facility 102 section will not be forcibly pulled down into the object that may be under the section. In an embodiment, there may be an indication to the user that the actuator 104 connection has come in contact with the first side of the slot and the adjustable bed facility 102 sections downward motion has been stopped. In an embodiment, the indication may be an audio indication, a visual indication, a motion indication (e.g. vibration), or the like to indicate to the user that the motion has been stopped and there may be an obstruction with the adjustable bed facility 102 section.

In an embodiment, there may be at least one vibration motor 118 that may provide vibration and massage functions to the adjustable bed facility 102 sections and mattresses 110. In an embodiment, there may be vibration motors 118 associated with any of the adjustable bed facility 102 sections. In an embodiment there may be more than one vibration motor 118 for each adjustable bed facility 102 section that may have vibration motors 118. In an embodiment, using the remote 148, the user may be able to control the vibration mode of the various vibration motors 118; the mode may include the vibration setting for a particular bed section, the vibration frequency of at least one of the vibration motors, stopping the vibration of at least one of the vibration motors, or the like. In an embodiment, the vibration motors 118 may be operated independently or in combination. In an embodiment, the user may select a vibration mode on the remote 148 and the control box 134 may use a software application to control the various vibration motors 118 to the user's request.

In an embodiment, the vibration motor 118 may be an electric/mechanical device, a pneumatic device, a hydraulic device, or the like. The mechanical device may use an electric motor to rotate an offset mass to create a vibration; the vibration motor may be controlled for vibration frequency and amplitude by the speed of rotation of the electric motor. Referring to FIG. 5A and FIG. 5B, an embodiment of a vibration motor 118 is shown within an opening of a adjustable bed facility 102 support lateral surface 508. The adjustable bed facility 102 section may have a lateral surface 508 and the lateral surface 508 may include an opening in which the vibration motor 118 may be located; the vibration motor 118 may fit within the opening such that the vibration motor 118 may not contact the lateral surface 508.

In an embodiment, the vibration motor 118 may be secured to the adjustable bed facility 102 section using at least one bracket 504. In an embodiment, when more than one bracket 504 is used, at least one of the brackets 504 may be separable and removable. In an embodiment, the at least one bracket 504 may be shaped to secure the vibration motor 118 within the section opening such as a straight bracket, a U shaped bracket, an L shaped bracket, or the like; in FIG.

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5A and FIG. 5B the bracket 504 is shown as a straight bracket 504. In an embodiment, the removal of one of the brackets 504 may facilitate securing the vibration motor 118 to the bed section, facilitating the servicing of the vibration motor 118, or the like. The bracket 504 may be positioned such that at least one portion of the bracket 504 is within the opening of the lateral surface 508 and may also be positioned such that the bracket 504 may overlap the vibration motor 118 flange. The bracket 504 may provide support to the vibration motor 118 flange along a majority of the perimeter of the mattress support opening. The bracket 504 may be coupled to the mattress support 508 using a removable coupling. Removing the bracket 504 may facilitate removing and servicing the vibration motor 118. The vibration motor 118 flange may extend beyond the perimeter of the opening of the mattress support 508 and the resilient material 502 may provide positional support for the motor so that the flange may impart vibration to the mattress without contacting the mattress support. The resilient material 502 may provide mechanical insulation between the flange and the perimeter of the opening in the mattress support 508. The resilient material 502 disposed between the flange and the lateral support 508 surface of the bracket 504 may further provide positional support for the vibration motor 118 housing.

The bracket 504 may be constructed using material such as plastic, metal, or the like, and may be constructed using the materials individually or in combination. In an embodiment, there may be a resilient material 502 associated with the brackets 504, the resilient material may provide for dampening the vibration between the vibration motor 118 and the adjustable bed facility 102, may contact the vibration motor 118 to secure the vibration motor 118 to the bed section, may provide for dampening of vibration to the adjustable bed facility 102 and hold the vibration motor 118 in place, or the like. The resilient material 502 may include latex foam, polyurethane foam, polypropylene foam, polyethylene foam, or the like and may be used individually or in combination.

In an embodiment, either of the pneumatic or hydraulic devices may act as a vibration motor 118 increasing and decreasing the pressure within a cylinder, bladder, or the like at certain frequencies to provide the vibration required by the user. In an embodiment, a device to provide the pressure frequency may be part of the vibration motor 118, a separate device from the vibration motor 118, or the like.

In an embodiment, the vibration facility 118 may be connected to the skeleton structure 114, the mattress 110, the lateral surface 508, or the like where the vibration may be imparted into the adjustable bed facility 102 mattress 110 as desired by the user. In an embodiment, the vibration motor 118 flange may provide surface area that may impart a vibration into the mattress 110. In another embodiment, the vibration motor 118 may be in proximity to a vibration distribution facility (not shown) that may aid in the propagation of vibration energy to the adjustable bed facility 102 section. In an embodiment, the vibration motor 118 may be operatively connected to the vibration distribution facility, may be in contact with the vibration distribution facility, may not be in contact with the vibration distribution facility, or the like. The vibration distribution facility may be constructed using materials such as plastic, rubber, metal, or the like and may be constructed using these materials individually or in combination. In an embodiment, the vibration distribution facility may provide for a more uniform distribution of the vibration characteristics of the vibration motor

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118 and may have a size and shape relative to the size and shape of the adjustable bed facility 102 section.

Referring again to FIG. 1, in an embodiment, the adjustable bed facility 102 may have an electronic facility 124 that may contain components that provide control of the physical aspects of the adjustable bed facility 102 (e.g. actuator, vibration motors), interface with the remote 148, interface with networks, interface with bed memory 154, control electronic devices of the adjustable bed facility 102, and the like.

In an embodiment, the control box 134 may coordinate the electronic requirements of the electronic facility 124. In an embodiment, the control box 134 may interface with the receiver 130, remote 148, air purification facility 144, power outlets, power connection 142, power supply 140, modular controls 132, wire harness 128, and the like. In an embodiment, the control box 134, receiver 130, and power supply 140 may be mounted directly to the skeleton structure 114. The control box 134, receiver 130 and the power supply 140 may be mounted on the center frame 1002.

Referring now to FIG. 14, in order to provide a proper mounting space to the control box 134, the receiver 130, and the power supply 140, an additional frame member 1402 may be added. The additional frame member 1402 may be made of a tubular construction. The additional frame member 1402 is designed in such a manner that it can bear the load of the components mounted on it.

In another embodiment, the control box 134, the receiver 130, and the power supply 140 may be mounted on any other frame member of the center frame 1002.

In an embodiment, the control box 134 may receive its command request from the user requesting adjustable bed facility 102 functions using the remote 148. In an embodiment, the remote may communicate to the receiver 130 and the receiver may transmit the received user command request to the control box 134. In an embodiment, the receiver 130 and control box 134 may be individual devices or a combined device.

In an embodiment, the remote 148 and receiver 130 may have wired or wireless communication. In an embodiment, the wireless communication may be by radio frequency (RF), infrared (IR), Bluetooth, or the like. In an embodiment, the receiver 130 may receive the user commands from the remote 130 and transmit the same command to the control box 134; the receiver may not provide any interpretation of the remote 148 commands. In an embodiment, the remote 148 and receiver 130 may be communication matched by the use of a code key. The code key may be any indicator that may be interpreted by the remote 148 and receiver 130 that commands may be received and executed between the remote 148 and receiver 130. In embodiments, the code key may be a number, a word, a serial number, a bed identification, a remote identification, a user identification, or any other identification known to both the remote 148 and receiver 130, all an indication that communications should be received. The code key may be transmitted as the beginning of the communication, the end of the communication, as part of the communication or the like.

In an embodiment, the skeleton structure 114 may be used as an RF antenna for receiving communication from the remote 148 to the receiver 130. In embodiment, the entire skeleton structure 114 may be used as an antenna; a portion of the skeleton structure 114 may be used as an antenna, or the like.

In an embodiment, the control box 134 may also control the functions of the adjustable bed facility 102 using a wireless technology in place of or in coordination with, the

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wire harness **128**. In an embodiment, the wireless technology may include Bluetooth, ultra-wideband (UWB), wireless USB (WUSB), IEEE 802.11, cellular, or the like. The various controlled functions (e.g. actuators **104** or external devices) may be able to communicate using the wireless technology, may use an intermediate wireless receiver, or the like to communicate with the control box **134**.

In an embodiment, the control box **134** wireless communication may use a wireless network protocol that may include peer-to-peer communication, master/slave communication, as a hub, as a server, or the like. In an embodiment, the wireless communication may be used to control more than one adjustable bed facility. For example, the user may be able to control his/her adjustable bed facility and may additionally be able to control another adjustable bed that may be within the range of the communication method.

In an embodiment, the cellular communication may utilize a cell phone, a smart phone, or the like to provide the communication method with the control box **134**, modular controls **132**, or the like. In an embodiment, the control box **134** may be controlled by a programmable control circuit (PLC). In an embodiment, the user may use a menu on the cell phone for adjustable bed functions that may be controlled by the cell phone. For example, the cell phone technology may be able to control the bed position and vibration characteristics of the adjustable bed facility **102** and therefore the cell phone menu may present the user with options for controlling the bed position and vibration.

In an embodiment, if the communication between the remote **148** and receiver **130** is wireless, the receiver learn facility **152** may be used to establish the communication between them. In an embodiment, a learn protocol between the remote **148** and receiver **130** may be user initiated by pressing a button on the receiver learn facility **152**, powering up the receiver learn facility **152**, bringing the receiver learn facility **152** within a certain proximity of the receiver **130**, indicating on the remote **152** to begin the learn protocol, or the like. In an embodiment, the learn protocol may be fully automatic, semi-automatic with user intervention, manual, or the like. In an embodiment, a user may select a channel, frequency, or the like during learn protocol or after the learn protocol. The changing of the channel, frequency, or the like may prevent two different remote **148** and receiver **130** combinations from interfering with other wireless communication devices. In an embodiment, each time the learn protocol is executed, a new unique communication link may be established; there may be a plurality of unique communication links available for each remote **148** and receiver **130** combination.

In an embodiment, the remote **148** may be a user controlled device to provide control commands to the control box **134** to command certain functions of the adjustable bed facility **102**. In an embodiment, the certain functions may be adjustable bed facility section movement (e.g. up or down), vibration control, modular controlled **132** devices, or the like. In an embodiment, the remote **148** may communicate with the control box using wired communication, wireless communication, or the like. In an embodiment, the wireless communication may use a radio frequency (RF), infrared (IR), Bluetooth, or the like. If the remote communicates using a wireless technology, the communication may be with the receiver **130** and the receiver **130** may pass the command request to the control box **134**.

In an embodiment, the inputs of the remote control **148** may be organized into groups of common function control; the remote control **148** groups may be arranged in a circular orientation. As shown in FIG. 3, the remote control **148** may

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include more than one group **302** and may include at least one positioning control group and one vibration control group. In one embodiment, the remote control **148** groups **302** may be organized into a circular pattern where the circular pattern may provide for inputs that control increasing a function, decreasing a function, storing a function, global command functions **304**, or the like. For example, a circular group **302** may be divided up into a number of segments to control certain functions of the adjustable bed facility **102**. FIG. 3 shows four sections for each of the circular groups **302**, but it should be understood that there may be any number of sections to provide the required adjustable bed facility **102** control.

In one example, one of the circular groups **302** may be used to control movements of the adjustable bed facility **102** sections. The movement circular group **302** may have inputs for moving the head section up/down, moving the foot section up/down, inputs for storing a user preferred positions to the PLC, or the like. Additionally, there may be a global command input **304** that may provide for commanding more than one adjustable bed facility **102** function using a single input such as commanding the adjustable bed facility **102** to go to a flat position. For example, the user may be able to select the flat button and the adjustable bed facility **102** may move all of the adjustable sections to the flat position.

A vibration circular group **302** may have inputs for controlling the vibration of the head section up/down, controlling the foot section vibration up/down, inputs for storing a user preferred vibration characteristics to the PLC, or the like. Additionally, there may be a global command input **304** that may provide for commanding more than one adjustable bed facility **102** vibration characteristic using a single input such as commanding the adjustable bed facility **102** to stop all vibration. For example, the user may be able to select the stop vibration input and the adjustable bed facility **102** may stop all of the adjustable sections from vibrating. In an embodiment, the user may select the all stop global **304** input to stop the adjustable bed facility **102** vibration before selecting a different vibration characteristic for one of the adjustable bed facility **102** sections.

In an embodiment, the user may be able to determine the control functions that the global command **304** may control. For example, the user may be able to input a command sequence to indicate the global command that should be applied to the global command **304** input. In an embodiment, the global command may be stored in the adjustable bed facility **102** memory **154** for later recall. In an embodiment, after the global command **304** has been stored, the user may select the global command **304** input for the command sequence execution.

The function of the remote **148** has been described with controlling adjustable bed facility **102** movement and vibration, but it should be understood that the remote may have control inputs for any function of the adjustable bed facility **102**. Additionally, the control inputs have been described as having a circular pattern, but it should be understood that other embodiments of the control input organization may be used for controlling the function of the adjustable bed facility **102**.

The remote **148** may include a timer that has a user defined setting that may allow the user to determine when the remote **148** communicates a control command to the adjustable bed facility. For example, the user may be able to set a timer on the remote **148** to indicate a time when the adjustable bed facility **102** is to go to a flat position. The user may use this function in the evening where the user may want to read for a half hour and then go to sleep, the user

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could set the timer for a half hour and the adjustable bed facility 102 may go to the flat position after the half hour. In another embodiment, the timer may be a clock where the user may be able to set a time when the adjustable bed facility 102 is to complete a certain function. In an embodiment, the user may be able to indicate the command that the remote 148 is to transmit to the adjustable bed facility 102 when the timer or clock setting indication has been reached.

In an embodiment, the remote 148 may be able to directly control the settings of external power outlets associated with the adjustable bed facility 148. The power outlet may be an RF controlled power outlet and the remote 148 may be able to transmit an RF command directly to the RF power outlet. In an embodiment, the power outlet may include settings of at least on, off, a percentage of power, or the like. The power outlet control power setting may be controlled by a hardware setting, a software setting, or the like. The power outlet may be an AC powered power outlet or a DC powered power outlet.

The remote 148 may include a timer that has a user defined setting that may allow the user to determine when the remote 148 communicates a control command to the RF power outlet. For example, the user may be able to set a timer on the remote 148 to indicate a time when the RF power outlet is to turn on or off. For example, the user may use this function in the evening where the user may want to read for a half hour and then go to sleep, the user could set the timer for a half hour to turn off a power outlet that controls a light fixture, after the half hour the remote 148 may command the RF power outlet to turn off and therefore turn the light fixture off. In another embodiment, the timer may be a clock where the user may be able to set a time when the RF power outlet may turn on or off. In an embodiment, the user may be able to indicate the command, such as on or off, that the remote 148 is to transmit to the RF power outlet when the timer or clock setting indication has been reached.

In an embodiment, the user may indicate adjustable bed facility 102 functions using the remote 148 by pressing a button, touching a screen, entering a code, speaking a command, or the like. In an embodiment, the control box 134, using the receiver 130, may receive and interpret the command provided by the remote 148. The remote may control devices with commands that may include on, off, high power, medium power, low power, volume, play, fast forward, rewind, skip, modular device to control, or the like. For example, the remote 148 may transmit a command to move the head section up and the control box 134 may command the actuator 104 to extend a certain amount in response to the command. In another example, the remote 148 may command that a modular control 132 connected lamp be turned off. The control box 134 may command the modular control 132 to turn off the lamp.

Referring again to FIG. 1, in an embodiment, the electronic facility 124 may use the bed memory 154 to store adjustable bed facility 102 settings, application software, demonstration software, and the like. In an embodiment, the user may determine that certain adjustable bed locations are preferred and should be saved for future recall. The control box 134 may save the user preferred settings in the bed memory 154 in order to recall the preferred settings at the use request. In an embodiment, the control box 134 may also store non-user requested information to the bed memory 154 as needed for the control of the various adjustable bed facility 102 components. For example, when the user requests an adjustable bed facility 102 section to move, the control box 134 may store the last position into bed memory

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154 to be used as a last position recall, an undo command, the last settings for all the adjustable bed facility 102 component at shutdown, or the like.

In an embodiment, the control box 134 application software may be stored in the bed memory 154. In an embodiment, the software may be downloaded to the control box 134, may be run from the bed memory 154, or the like. In an embodiment, the application software may be an interrupt type application, a polling type application, or the like for sensing what command the user may have indicated on the remote 148. For example, in an interrupt application, each command requested by the remote 148 may send an interrupt code to the control box 134. The control box 134 may then request from the application software the command sequence that is associated with the received interrupt. In another example, the polling application may continually poll the remote 148 for requested user commands and when a user command is detected, then request the command sequences for the requested user command.

In another embodiment, the control box 134 may use programmable logic circuits (PLC) to store application programs for control of the adjustable bed facility components. In an embodiment, the PLC may be part of the control box 134, part of a bed memory 154, in a separate control box, or the like. In an embodiment, the PLC may include a microcomputer, a microprocessor, volatile memory, non-volatile memory, IO connection to components, or the like. The PLC may provide an interface to permit software application updates to the PLC memory; PLC memory may be over written. In an embodiment, this may provide a method and system for providing software application upgrades to the adjustable bed facility 102.

In an embodiment, the PLC may have a connection to an external interface that may allow updates to be downloaded to the PLC. The connection may be a serial connection, a USB connection, a USB device, a parallel connection, a wireless connection, a bed memory 154, or the like. The capability to download information to the PLC may allow for software updates to the PLC, may allow for remote 148 interface updates to the PLC, may allow memory updates to the PLC, or the like. For example, if the user was supplied with a new or upgraded remote 148, the user may also be supplied with updated software for the PLC. The user may be able to connect the device containing the new software to the external interface and download the new software to the PLC.

In an embodiment, the PLC may have a connection interface with the modular controls 132 to provide the user with control over other devices that may be connected to the adjustable bed facility 102. The PLC may receive commands from the remote 148 for the modular controls 132 and may pass the command through to the modular control 132, may interpret the remote 148 command and command the modular control 132, or the like.

In an embodiment, the PLC may interface with a modular control 132 that is associated with external power outlets. In this embodiment, the user may be able to control the setting of the external power outlet by selecting a setting on the remote 148. The setting on the remote 148 may be received by the receiver 130 and PLC within the control box 134 to set the power outlet setting. For example, the user may be able to turn on the external power outlet by selecting an external outlet on input on the remote. This may result in the external outlet power being turned on to power an attached device such as a lamp.

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In an embodiment, the bed memory 154 may be part of the PLC, external from the PLC, a combination of internal and external memory from the PLC, or the like.

In an embodiment, the bed memory 154 may be separate from the control box 134 and the PLC. In an embodiment, the bed memory 154 may be removable memory, the bed memory 154 may be moved from a first adjustable bed facility 102 to a second bed facility 102 to move user settings from the first adjustable bed facility 102 to the second bed facility 102. For example, a user in a care facility may be moved from a first adjustable bed facility 102 to a second adjustable bed facility 102 but the user may have already determined and saved at least one preferred setting to the bed memory 154. The bed memory may be removed from the first adjustable bed facility 102 and moved to the second adjustable bed facility 102 with the user and therefore the user may keep the same preferred adjustable bed 102 settings.

In this manner the bed memory 154 may be considered portable memory. In an embodiment, the removable bed memory 154 may be flash memory, programmable logic circuit (PLC), secure digital (SD) memory, mini SD memory, Compact Flash type I memory, Compact Flash type II memory, Memory Stick, Multimedia Card, xD Picture card, Smartmedia, eXtreme Digital, Microdrive, or the like.

In an embodiment, the bed memory 154 may be part of the remote 148. As part of the communication between the remote 148, receiver 130, and control box 134 memory information may be exchanged between the remote 148 and control box 134. For example, the user may indicate that a certain adjustable bed facility 102 position should be maintained for future recall. The control box 134 may receive the save position request from the remote 148 and transmit the position information back to the remote 148 for storage within the bed storage 154. In a like manner, when the user requests the recall of a previously saved position, the control box 134 may request the position information from the remote 148 bed memory 154.

In an embodiment, if the remote 148 is wireless, the remote 148 may contain both a transmitter and receiver, or a transceiver, to transmit and receive information with the control box 134. In an embodiment, the remote 148 may communicate with the receiver 130 using a connection key. The connection key may be a code that indicates that a certain remote is associated with a certain adjustable bed facility 102. When the remote 148 transmits information to the receiver, the remote may first send a key code to indicate that the remote 148 is associated with the adjustable bed facility 102. If the key code matches the key that the receiver 130 is listening for, the receiver 130 may receive the command from the remote.

In an embodiment, the bed memory 154 may maintain the position information for the user preferred positions of the adjustable bed facility 102 sections. In an embodiment, the bed memory 154 may be implemented as a programmable logic circuit (PLC), a logic circuit (LC), or the like. FIG. 2 shows an embodiment of two methods of maintaining the user preferred positions in memory. In an embodiment, a first method may be to have discreet memory table 202 for each preferred user bed position 204. There may be the same number of preferred bed positions 204 and memory locations 208 as indicators on the user remote 148. For example, the remote may have two buttons for the user to set the preferred positions that may be used for later recall; the two buttons may be associated with two discreet memory locations 208. In an embodiment, each time the user indicates a new preferred position for a button on the remote 148 the

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memory location 208 may be over written with the new position information. In an embodiment, this method may only allow the user to set one user preferred position for every button on the remote 148.

In an embodiment, a second method of memory storage for user preferred adjustable bed positions may be a table 222 that may have a plurality of possible positions 212 the user may select. In an embodiment, as shown, the possible positions 212 may be P1 through Pn. In an embodiment, the possible positions 212 may be a plurality of values that may define the range of available positions for the adjustable bed facility 102; the plurality of values may be a set of values that define the range of available positions for one or more adjustable bed facility 102 functions. For example, the available positions 212 may be a set of increments of section positions that may include a set of actuator 104 positions, a set of actuator 104 activation times, bed section rotation angles, or the like. The set of increments may be determined from a base value for the section. For example, the increments may start at zero from the flat position for the adjustable bed facility 102 section. In an embodiment, the user may be able to select the increment set to be used as possible positions 212 for the section. For example, the user may be able to select the type of graduations by selecting from a set of possible graduation methods such as distance, angle of rotation, actuation time, or the like.

In FIG. 2, the table 222 is shown with an increment column 210 and an indication column 220. In an embodiment, the table 222 may have a plurality of columns 220 to store position information for any of the adjustable aspects of the adjustable bed facility 102. For example, there may be an indication column 220 for the head section angle, the foot angle section, the vibration characteristics for the various vibration motors of the adjustable bed facility 102, or the like. In another embodiment, the adjustable aspects of the adjustable bed facility 102 may be represented by a plurality of individual tables 210 for storing indication information for each of the individual adjustable attributes for the adjustable bed facility 102. The individual tables 210 may be substantially the same as the table 222 shown in FIG. 2 where there may be one column 210 for increments 212 and another column 220 for indication information (214 and 218). For example, there may be individual tables 210 for the head section angle, foot section angle, vibration motor characteristics, or the like. In an embodiment, the PLC may be able to access the adjustable bed facility 102 settings by accessing large tables 210 that contain many columns, small tables 210 that contain a few columns, a combination of large and small tables 210, or the like.

In an embodiment, the PLC may store the tables 210 within the PLC memory for accessing the settings of the adjustable bed facility 102. In another embodiment, the table 222 may be stored in memory outside of the PLC and the PLC may access the table 222 through an interface connection. The table 222 increment column 210 may represent a plurality of available positions associated with adjustable bed facility functions. In an embodiment, the increment values may be a measurement scale (e.g. inches or angle), may be the number of rotations of the actuator, the vibration frequency of the vibration motor, or other increment scale. In response to a user input, the indication column 220 may be marked with the indication 214 to represent the position intended by the user. When the user makes a request to save a position, the PLC may search the increment column 210 to determine which of the plurality of increments 212 represents the current position value of the adjustable bed facility 102 section. Once the current position value increment 212

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within the table 222 is determined, an indication 214 may be stored to the indication column 220 associated to the current position value increment 212. In an embodiment, the indication 214 may be any character that may represent a position being selected such as a letter, a number, special character, or the like. In embodiments, the indication column 220 may include all indications, no indications, one indication, more than one indication, or the like to indicate the user's intended position. The storing of the indication association of the current position value with the user selected position may include adding a store indication to the table 222 entry representing the current position value, removing the current position value from the table 222 of values, removing a plurality of the table 222 values where the removal does not include removing the current position value, adding a store indication to every table 222 entry except a table 222 entry representing the current position value, or the like.

In an embodiment, when a user indicates on the remote 148 that a position is to be saved in the table 222, the PLC may select the increment value 212 from within the increment column 210 set of values that represents the current position of the adjustable bed facility 102. The PLC may store an indication 214 associated with the increment value 212; the stored indication associated with the current position value may be a recall value that may be recalled at a later time to reposition the adjustable bed facility 102.

In an embodiment, in response to the user requesting to return to a recall value, the PLC may scan the table 222 indication column 220 for an indication 214 that may represent the user's recall value. Upon locating the recall value indication 214, the PLC may command the adjustable bed function to the recall value indicated 214 location, position, vibration, or the like.

In an embodiment, the indication column 220 of the table 222 may initially contain indications 214 in all to the available discrete locations 212. As a user indicates that current position value is the position to be stored within the table 222, the indication 214 for the current position value may be removed from the table 222. This may result in one increment location 212 being empty of an indication. In this case, when a user requests to return to the recall position, the PLC may scan the table 222 indication column 220 for the empty increment location 212. Once the empty increment location is found, the PLC may command the adjustable bed function to the recall position, vibration, or other adjustable bed facility 102 function. In an embodiment, if the user stores a different current position value, the empty discrete location 212 may be filled with an indication and the new indication associated to the current position value may have the indication 214 removed. In an embodiment, the user may be able to clear the stored position by indicating a clear command and all of the increment locations 212 may be filled with indications 214.

In an embodiment, the available increment locations 212 in the indication column 220 of the table 222 may initially contain no indications 214 so that the indication column 220 may be empty. As a user indicates that a current position value is the position to be stored within the table 222, the indication 214 associated to the current position value may be added to the table 222. This may result in one increment location 212 having an indication. In this case, when a user requests to return to recall value position, the PLC may scan the table 222 indication column 220 for the increment location 212 containing the indication 214 associated with the recall value. Once the increment location is found, the PLC may command the adjustable bed function to the recall

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value position, position, vibration, or other adjustable bed facility 102 function. In an embodiment, if the user stores a different position, the increment location 212 indication 214 may be removed and the new current position value may have the indication 214 added. In an embodiment, the user may be able to clear the stored position by indicating a clear command and all of the discrete locations 212 may have the indication 214 removed.

In an embodiment, when a user indicates a current position value is to be indicated in the table 222, the indication may represent the user's preferred adjustable bed facility 102 position. In an embodiment, the user's indicated current position value may be rounded to the closest table 222 increment location 214. For example, if the user selects a current position value that is between two increment positions on the table 222, an algorithm may be used to determine which of the increment positions are to be indicated in the indication column 220.

Embodiments of the present invention involve setting a recall bed position in response to a user making a storage selection. The user's storage selection may send a command to the adjustable bed facility's 102 controller (e.g. the PLC) indicating that the user would like the present position of the adjustable bed facility 102 stored such that the user can later have the adjustable bed facility 102 return to the stored position. The user may use a user interface (e.g. the remote control 148) and make such a storage selection once the adjustable bed facility 102 is in a desired position. As described herein elsewhere, a plurality of position values that define a range of available positions for the adjustable bed facility 102 may be stored in memory accessible by the adjustable bed facility's 102 controller. The available positions may be stored in a table 222 or other structure for example. Once the user initiates such a storage request, the controller may receive the request to save the current adjustable bed facility 102 position as a user selected position. The controller may then make a determination of which of the plurality of position values represent the current position of the adjustable bed facility 102 to provide a current position value. In determining which of the plurality of position values represents the current position, the controller may use an algorithm to decide which of the plurality of values best represents the current adjustable bed facility 102 position. For example, the actual adjustable bed facility 102 position may match one of the values and the algorithm may then select the matching value as the one that best represents the current position. In another situation, the actual adjustable bed facility 102 position may not match any of the plurality of values. In this case an algorithm may be used to determine which value best represents the position of the adjustable bed facility 102. The algorithm may run an averaging calculation, interpolation calculation or other form of prediction algorithm to select between two positions representing positions on either side of the actual adjustable bed facility 102 position, for example. Once the controller has made the determination as to which value represents the current adjustable bed facility 102 position, the controller may then store an association of the current position value with the user-selected position (e.g. as described elsewhere herein).

The embodiment of unmarking 218 preferred positions will be used in the following illustrations, but it should be understood that marking a current position value may also be used as a method of indicating a preferred position 212.

In an embodiment, the user may indicate the current position value by indicating a set position on the remote 148; this indication may result in all of the possible increment

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locations **212** having an indication **214** except for the one increment the user has selected which may be non-marked **218**. For example, if the user selected the P3 position **212** as a preferred position, all of the positions **212** may receive a mark **214** except the one position P3 which may receive a non-mark **218**.

In an embodiment, the positioning recall position logic of the adjustable bed may seek possible positions **212** that do not have a mark **218** when determining what user positions to select.

In an embodiment, the user may be able to set more than one increment position **212** in the table **222** for a single button on the remote **148**. For example, the user may be able to press a button on the remote **148** in a certain way to set a non-mark **218** at different preferred positions **212**. In another example, when the user presses a button on the remote **148**, the current position value may be unmarked **218** as a preferred position and an algorithm may be executed to unmark **218** other preferred positions **212** at certain increments from the user selected position. In one example of the algorithm, every 3rd position may be selected to be unmarked **218** as a preferred position **212**. The additional non-markings **218** may be by actuation time, section rotation angle, or the like. A person skilled in the art may understand that there may be any number of different methods of unmarking more than one position **212** using a single button on the remote **148**.

In an embodiment, with user preferred positions **212** unmarked **218** on the table **222**, the user may indicate on the remote **148** to recall the user preferred position **212**. In an embodiment, there may be an algorithm to search the table **222** for an unmarked **218** user preferred position **212** to position the bed to the recall value. Once the preferred position **212** is determined, the command logic may command the actuator or actuators to move the adjustable bed sections into the preferred position **212** recall value. In an embodiment, there may be more than one preferred position **212** unmarked **218** on the table **222**. In this case, the algorithm may seek the first unmarked **218** position **212** and move the adjustable bed section to that position. In an embodiment, if this is not the user desired position, the user may indicate again on the remote to recall a preferred position and the algorithm may seek the next unmarked **218** position **212**. A person skilled in the art may understand that there may be a number of different methods of recalling a plurality of marked **214** or unmarked **218** positions **212** from the table **222**.

Referring again to FIG. 1, in an embodiment, the removable bed memory **154** may be used to upgrade the adjustable bed facility **102** memory and software. For example, if new control box **134** software was developed to provide better control over one of the adjustable bed facility **102** components, the software may be saved to a new replaceable memory that may replace the existing replaceable memory. In this manner, the software of the adjustable bed facility **102** could be upgraded just by providing the user with a new replaceable memory.

In an embodiment, the removable memory may be used to provide a sales enterprise with adjustable bed facility **102** demonstration software where the enterprise may be able to indicate at least one of a plurality of demonstrations for a user. For example, the user may be interested in how the adjustable bed facility **102** sections may be adjusted and the enterprise may select a demonstration to shows all the section motion available. In an embodiment, before an adjustable bed facility **102** is shipped to a user, the enterprise

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may remove the demonstration removable memory and replace it with a standard adjustable bed facility **102** bed memory **154**.

In an embodiment, the memory connection **160** may be any connection type that provides a connection between the bed memory **154**, control box **134**, and the like. In an embodiment, the memory connection **160** may be a wired or wireless connection. The wired connection may be a USB connection, a serial connection, parallel connection, or the like. The wireless connection may be by radio frequency (RF), infrared (IR), Bluetooth, or the like. In an embodiment, the memory connection **160** may be in a location that is easy for the user to access the bed memory **154**, may be attached to the memory facility **150**, may be attached to the control box **134**, or the like. In an embodiment, the easy access memory connection may be on the side of the adjustable bed facility **102**, on a rail of the adjustable bed facility **102**, under the adjustable bed facility **102**, or the like.

In an embodiment, the control box **134** may also access a network using a network connection **162**. In an embodiment, the network may be a LAN, WAN, Internet, intranet, peer-to-peer, or other network with computer devices that the control box **134** may communicate with. In an embodiment, the network connection **162** may be a wired or wireless connection.

In an embodiment, using the network connection **162**, the control box **134** may be able to communicate with the network to periodically check for application software updates. In an embodiment, if an application software update is located, the control box **134** may send the user an email, instant messenger message, phone message, phone call, cell phone message, cell phone call, fax, pager message, or the like to indicate that software updates are available. The user, using the device that received the notice of software update, may send a reply to the control box that the software upgrade should be downloaded, should not be downloaded, or the like.

In an embodiment, an adjustable bed facility **102** enterprise, an adjustable bed facility **102** manufacturer, an adjustable bed facility **102** service enterprise, or the like may send the control box **134** software updates using the network connection **162**. In an embodiment, an adjustable bed facility **102** enterprise, an adjustable bed facility **102** manufacturer, an adjustable bed facility **102** service enterprise, or the like may notify the user of available software upgrades for the adjustable bed facility **102** by email, instant messenger message, phone message, phone call, cell phone message, cell phone call, fax, pager message, or the like. The user, using the device that received the notice of software upgrade, may send a reply to the adjustable bed facility **102** enterprise, the adjustable bed facility **102** manufacturer, the adjustable bed facility **102** service enterprise, or the like that the software upgrade should be downloaded, should not be downloaded, or the like.

In an embodiment, the user may access the network connection **162** with the user's own computer device.

In an embodiment, the remote **148** and control box **134** may be able to control other devices that may be connected to modular controls **132**. In an embodiment, the modular controls **132** may be similar to the control box by interpreting commands to control a device, but may be unique to the device that is connected to it. In an embodiment, the modular controls **132** may control audio equipment, video equipment, lamps, air purification facilities, outlets, and the like. For example, the modular control **132** may be connected to audio equipment and may contain the command sequences to control the audio equipment based on commands that may

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be received from the remote **148**. It may be obvious to someone in the art that any of the devices that are connected to modular controls **132** may be controlled in the same manner.

In an embodiment, the user may indicate a function to be accessed for a certain device connected to a modular control **132**, the control box **134** may receive the request from the remote **148** and pass the command onto the appropriate modular control **132**. In an embodiment, the remote **148** may have modular control **132** device functions that the user may select to control a modular control **132** device. For example, the remote **148** may have functions such as play, fast-forward, rewind, skip, pause, and the like for an audio device connected to the modular control **132**.

In an embodiment, the modular controls **132** may be connected to the control box **134** and power supply **140** using a wire harness **128**. The wire harness **128** may contain power and data connections for all of the possible connection locations for the modular controls **132**. For example, if there are six locations on the adjustable bed facility **102** for attaching modular controls **132**, the wire harness **128** may have six sets of power and data connections available.

In another embodiment, the wire harness may provide only power to the modular controls **132** and the communication between the modular controls **132** and control box **134** may be wireless that may include radio frequency (RF), infrared (IR), Bluetooth, and the like.

In an embodiment, using the remote **148**, the control box **134** may be able to control power outlets **138** to which external devices may be connected; the power outlets may be associated with the adjustable bed facility **102**, remote from the adjustable bed facility **102**, or the like. In an embodiment, the control box may communicate with the power outlet using wired or wireless communications. In this embodiment, the power outlets **138** may receive power directly from a household outlet, fuse box, circuit box, or the like but the function of the power outlets **138** (e.g. on or off) may be controlled by the control box **134**. For example, an external lamp may be connected to the power outlets **138**, there may be a selectable control on the remote **148** for the user to turn the power outlet **138** on and off and therefore to turn the lamp on and off. In an embodiment, the power outlets **138** may include a control circuit that is able to control if the power outlet **138** receives power from the household current. In an embodiment, there may be more than one power outlet controlled by the control box **134** and there may be a selection for each of the power outlets **138** on the remote **148**.

In an embodiment, the power outlets **138** may be directly controlled by the remote control **148** using radio frequency (RF). The remote control and power outlets may be RF capable for communication within the adjustable bed facility **102**. The remote control **148** may be able to directly control the power outlets **138** to turn the power outlets on and off using RF without interfacing with the control box **134**.

In an embodiment, the control box **134** may be able to control an external air purification **144** facility; the air purification **144** facility may be directly controlled by the control box using a wired or wireless connection. In an embodiment, the wireless connection may be radio frequency (RF), infrared (IR), Bluetooth, or the like. In an embodiment, the air purification facility **144** may be any type of device or facility that may be capable of improving that air environment in the area of the adjustable bed facility **102**. In an embodiment, the air purification facility **144** may be an absorbent type (e.g. carbon), electro-static, HEPA filter, or the like. In an embodiment, absorbent materials may

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be used in a filter, in the adjustable bed facility **102**, in the mattress **110**, or the like to absorb odor, dust, contaminants, or the like from the air environment around the bed, within the bed, or the like. In an embodiment, electro-static or ionic air filters may use negative ions to attract dust, contaminants, and the like from the air. In an embodiment, electro-static materials (e.g. tourmaline) may be used in a filter, in the adjustable bed facility **102**, in the mattress **110**, or the like to absorb odor, dust, contaminants, or the like from the air environment around the bed, within the bed, or the like. In an embodiment, HEPA filters are composed of a mat of randomly arranged fibers that are designed to trap at least 99.97% of dust, pollen, mold, bacteria, and any airborne particles with a size of 0.3 micrometers (μm) at 85 liters per minute (Lpm). The HEPA filter may be used in a device, facility, or the like for filtering the air in the area of the adjustable bed facility **102**.

In an embodiment, the air purification facility **144** may be part of the adjustable bed facility **102**, a freestanding device or facility, or the like. In an embodiment, if the air purification facility **144** is part of the adjustable bed facility **102** the air purification facility **144** may be attached to any part of the adjustable bed facility **102** such as the mattress **110**, sub-frame **112**, skeleton structure **114**, or the like. In an embodiment, the air purification facility **144** that is attached to the adjustable bed facility **102** may be controlled direct control of the air purification facility **144** device, control using the remote **148**, or the like.

In an embodiment, the air purification facility **144** may be a free standing device that may be plugged into a adjustable bed facility **102** power outlet **138** and therefore may be controlled with the remote **148** controlling the on/off condition of the power outlet **138**.

In an embodiment, the air purification facility **144** may be a freestanding device that may be connected to an adjustable bed facility **102** modular control **128**. The modular control may provide power (AC or DC), control communication, and the like to the air purification facility **114**. In an embodiment, the user may be able to control the air purification facility **144** using the remote **148** to control the modular controls **132**.

In an embodiment, an adjustable bed facility **102** may be any bed that is capable of adjusting at least one aspect of the bed such as a head section, a foot section, a leg section, a torso section, or the like. In an embodiment, the adjustment may include moving the sections up, down, higher, lower, longer, shorter, and the like. In an embodiment, the section adjustments may also include vibration, massage, and the like. In an embodiment, the adjustable bed facility **102** may include components such as actuators **104**, springs **108**, a mattress **110**, a sub-frame **112**, a skeleton structure **114**, vibration motors **118**, supports **120**, safety brackets **122**, wire harness **128**, receiver **130** modular controls **132**, control box **134**, power outlets **138**, power supply **140**, power connection **142**, air purification facility **144**, remote control **148**, receiver learn facility **152**, bed memory **154**, backup battery **158**, memory connection **160**, network connection **162**, and the like.

In an embodiment, the adjustable bed facility **102** sections may be adjustable by a user, a care giver, a medical person, or the like to provide a comfortable position, a medical required position, a working position, a resting position, or the like. For example, a medical position may be required to have a user's legs elevated to aid in the reduction of swelling and therefore the leg or foot sections may be elevated. In another example, a user with a back condition may need to rest his or her back and may still wish to work, the user may

be able to position the adjustable bed facility **102** to provide a comfortable back position that allows the user to work on papers or a computer device.

In an embodiment, the adjustable bed facility **102** may be used in a home, a hospital, a long-term care facility, or the like. The adjustable bed facility **102** may be used by users that may have limited mobility, are restricted to bed rest, require a non-flat sleeping position, and the like.

In an embodiment, actuators **104** may be used to move the adjustable bed facility **102** sections. The actuator **104** may typically be a cylinder device where a first component, under a force, is extendable from second component that may result in the action of moving an object. In an embodiment, there may be more than one actuator **104** per adjustable bed facility **102**. There may be an actuator **104** to move any of the adjustable bed facility **102** sections or other aspects of the adjustable bed facility **102**. For example, there may be individual actuators for the head section, leg section, foot section, torso section, or the like. In an embodiment, a single actuator may be used to move more than one adjustable bed facility **102** section. For example, one actuator may be used to move the leg and foot sections; the leg and foot sections may be connected by a mechanical structure that may control the orientation of the leg and foot sections during movement. In an embodiment, the actuators **104** may be connected between the adjustable bed facility **102** section to be moved and the sub-frame **112**, skeleton structure **114**, or the like.

In an embodiment, the actuator **104** may have different driving means to extend and retract the actuator **104** such as an electric motor, pneumatic pressure, hydraulic pressure, or the like.

In an embodiment, the electric motor driven actuator **104** may use a DC or AC motor and gear assembly to extend and retract the actuator **104**.

In an embodiment, the pneumatic pressure actuator **104** may use an air source to extend and retract the actuator **104**. The air source may be part of the pneumatic actuator **104**, may be a separate device, or the like. In an embodiment, the separate air source device may be part of the adjustable bed facility **102** or may be external to the adjustable bed facility **102**.

In an embodiment, the hydraulic pressure actuator **104** may use a fluid source to extend and retract the actuator **104**. The fluid source may be part of the hydraulic actuator **104**, may be a separate device, or the like. In an embodiment, the separate fluid source device may be part of the adjustable bed facility **102** or may be external to the adjustable bed facility **102**.

In an embodiment, springs **108** may be used with a mattress **110**, instead of a mattress **110**, or the like. In an embodiment, the springs may be a standard bed spring system (e.g. coils within a wire framework), individual coil springs, individual foam springs, air springs, or the like. In an embodiment, the individual springs (e.g. coil, foam, or air) may be used to provide variable firmness to provide comfort to the user. For example, the springs **108** may be less firm or firmer in a local area to provide the user with the support that may be required for a body location that is experiencing discomfort (e.g. a hip, shoulder, back, neck).

In an embodiment, the mattress **110** may include foam, feathers, springs **108**, material, or the like. In an embodiment the different materials may be used individually or in combination. The mattress may be intended to provide the user with a firmness that provides for the comfort requirements of the user.

In an embodiment, the mattress **110** may be an air mattress. In an embodiment, the air mattress may be constructed using a single chamber, a plurality of chambers, a plurality of individual chambers, a combination of chamber shapes, or the like. In an embodiment, the air mattress **110** may be inflated to various pressures that may provide the user with the desired comfort level. In an embodiment, there may be separate air mattresses **110** for each of the adjustable bed facility **102** sections. For example, there may be separate air mattresses **110** for the head, torso, and foot sections of the adjustable bed facility **102**. In an embodiment, the inflation pressure of the individual air mattresses **110** may be different from each other depending on user settings.

In another embodiment of an air mattress **110** with individual chambers, local firmness control may provide local firmness comfort to a user to provide comfort. For example, a user may be recovering from surgery and may require the air mattress **110** to be less firm in a certain area, the user may be able to indicate the area to be less firm and the individual chamber pressures may be adjusted to provide the less firm area. Additionally, while a local area may be provided with a less firm pressures, the remainder of the mattress **110** may have a consistent firmness pressure.

In an embodiment, the sub-frame **112** may be a structural support frame in contact with the floor and may include the floor legs, connections for the actuators **104**, connections for the supports **120**, support for the skeleton structure **114**, and the like. In an embodiment, the sub-frame **112** materials may include wood, metal, plastic, and the like. In an embodiment, the sub-frame **112** may provide a support interface to the skeleton structure **114** and may support the freedom of motion for the skeleton structure **114**. For example, the sub-frame **112** may include an interface such as a track, surface, groove, slot, or the like in which the skeleton structure **114** may interface and use as a guide while providing motion support for the various adjustable bed facility **102** sections. In an embodiment, the sub-frame **112** interface may be a "C" channel in which the skeleton structure **114** may have interfacing wheels to move within the "C" channel during the adjustable bed facility **102** section movements.

In an embodiment, the sub-frame **112** may be substantially the same shape as the adjustable bed facility **102** and may have structural members along the length and width of the sub-frame **112**. In an embodiment, the structural members may be assembled in any configuration that meets the requirements of supporting the adjustable bed facility **102** and the various devices such as the actuators **104**, supports **120**, skeleton structure **114**, and the like.

In an embodiment, the skeleton structure **114** may be a mechanical structure that may provide support to the springs **108**, provide support to the mattress **110**, interface with the sub-frame **112**, provide a connection to the actuators **104**, provide a connection to the supports **120**, support the vibration motors **118**, and the like. In an embodiment, there may be more than one skeleton structure **114** within the adjustable bed facility **102**; there may be a skeleton structure **114** for each adjustable bed facility **102** section. For example, there may be a skeleton structure **114** for the head section, foot section, leg section, torso section, and the like.

In an embodiment, the skeleton structure **114** may be a frame type structure to support at least one mattress **110**, provide connectivity between more than one mattress **110**, contain a hinge mechanism to allow the motion of a first mattress **110** in relation to a second mattress **110**, and the like. The frame structure may be substantially the same shape as the mattress **110** that the skeleton structure **114** is

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supporting and may have individual structure members at the peripheral edges of the mattress 110 in addition to other individual structural members that may be required for support of mechanical connections, support of the mattress 110, or the like. In an embodiment, the skeleton structure 114 may include materials such as metal, wood, plastic, and the like. The skeleton structure 114 materials may be used individually or in combination.

In an embodiment, the skeleton structure 114 may have an interface facility such as wheels, slides, skids, rails, pivot points, and the like that may interface with the sub-frame 112 support interface. The skeleton structure 114 interface facility may provide for smooth interaction with the sub-frame 112 support interface when the skeleton structure 114 is in motion as a result of actuation from the actuators 104.

In an embodiment, a vibration facility 118 may provide vibration input to the adjustable bed facility 102 sections such as the head section, foot section, leg section, torso section, and the like; there may be vibration facilities in any or all of the adjustable bed facility 102 sections. In an embodiment, the vibration facilities 118 may be operated independently, at the same time, at alternate times, in coordination, or the like. For example, the vibration facilities in the head section and foot section may be operated at the same time to provide a full body massage or the vibration frequencies may operate at alternating times to provide a wave effect of the vibration moving from the head to foot of the adjustable bed facility 102. In another example, the different vibration facilities 118 may be used in concert where the vibration facilities 118 may be vibrated in sequences to create a massaging effect. It may be understood by one knowledgeable in the art that different effects may be created with more than one vibration facility 118.

In an embodiment, using the remote 148, the user may be able to control the vibration mode of the various vibration motors 118; the mode may include the vibration setting for a particular bed section, the vibration frequency of at least one of the vibration motors 118, stopping the vibration of at least one of the vibration motors, or the like. The remote 148 may provide vibration motor 118 control information to the adjustable bed facility 102 control box 134 for control of the vibration characteristics of the adjustable bed facility 102. In an embodiment, the remote 148 may include user inputs that include at least one of head vibration increase, head vibration decrease, foot vibration increase, foot vibration decrease, user preferred vibration settings, vibration stop, or the like.

In an embodiment, the vibration motor 118 may be capable of a plurality of vibration frequencies. For example, the vibration motor 118 may be able to operate on frequencies such as high, medium, low, settings 1-10, or the like. In an embodiment, a first vibration frequency may be stopped before a second vibration frequency is started. In embodiments, the stopping between the first vibration and the second vibration may be automatic and controlled by the logic within the control box 134, may be manually indicated by the user using the remote 148, or the like. As an example of manual input, the vibration motor 118 may be operating on a medium frequency and the user may provide a stop vibration input on the remote 148 to stop the first vibration motor 118 vibration before pressing the low vibration frequency input.

Referring to FIG. 5A and FIG. 5B, an embodiment of a vibration motor 118 is shown within an opening of a adjustable bed facility 102 support lateral surface 508. The adjustable bed facility 102 section may have a lateral surface 508 and the lateral surface 508 may include an opening in

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which the vibration motor 118 may be located; the vibration motor 118 may fit within the opening such that the vibration motor 118 may not contact the lateral surface 508. In an embodiment, the vibration motor 118 may be secured to the adjustable bed facility 102 section using at least one bracket 504. In an embodiment, when more than one bracket 504 is used, at least one of the brackets 504 may be separable and removable. In an embodiment, the at least one bracket 504 may be shaped to secure the vibration motor 118 within the section opening such as a straight bracket, a U shaped bracket, an L shaped bracket, or the like; in FIG. 5A and FIG. 5B the bracket 504 is shown as a straight bracket 504. In an embodiment, the removal of one of the brackets 504 may facilitate securing the vibration motor 118 to the bed section, facilitating the servicing of the vibration motor 118, or the like. The bracket 504 may be positioned such that at least one portion of the bracket 504 is within the opening of the lateral surface 508 and may also be positioned such that the bracket 504 may overlap the vibration motor 118 flange. The vibration motor 118 flange may extend beyond the perimeter of the opening of the mattress support and the resilient material 502 may provide positional support for the vibration motor 118 so that the flange imparts vibration to the mattress 110 without contacting the mattress support. The at least one bracket 504 may be coupled to the mattress support 508 using a removable coupling. Removing the at least one bracket may facilitate removing and servicing the motor. The resilient material 502 may provide mechanical insulation between the flange and the perimeter of the opening in the mattress support 508. The resilient material 502 disposed between the flange and the lateral support 508 surface of the at least one bracket 504 may further provide positional support for the vibration motor 118 housing. The bracket 504 may be constructed using material such as plastic, metal or the like and may be constructed using the materials individually or in combination. In an embodiment, there may be a resilient material 502 associated with the brackets 504, the resilient material may provide for dampening the vibration between the vibration motor 118 and the adjustable bed facility 102, may contact the vibration motor 118 to secure the vibration motor 118 to the bed section, may provide for dampening of vibration to the adjustable bed facility 102 and hold the vibration motor 118 in place, or the like. The resilient material 502 may include latex foam, polyurethane foam, polypropylene foam, polyethylene foam, or the like and may be used individually or in combination.

In an embodiment, the vibration facility 118 may be connected to the skeleton structure 114, the mattress 110, the lateral surface 508, or the like where the vibration may be imparted into the adjustable bed facility 102 mattress 110 as desired by the user. In an embodiment, the vibration motor 118 flange may provide surface area that may impart a vibration into the mattress 110. In an embodiment, the vibration motor 118 may be secured to the adjustable bed facility 102 section using two separable brackets; at least one of the two separable brackets may be removable. In an embodiment, the removal of one of the brackets may facilitate securing the vibration motor 118 to the bed section, facilitating the servicing of the vibration motor 118, or the like. The bracket may be constructed using a material such as plastic, metal, or the like and may be constructed using the materials individually or in combination. In an embodiment, there may be a resilient material attached to the brackets, the resilient material may provide for a dampening the vibration between the vibration motor 118 and the adjustable bed facility 102, may contact the vibration motor

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118 to secure the vibration motor **118** to the bed section, or the like. For example, the brackets may be attached to the adjustable bed facility **102** section with the resilient material making contact with the vibration motor **118** that may be in an opening of the section. The resilient material may provide the force required to hold the vibration motor in place within the section opening and may provide dampening of the vibration to the adjustable bed facility. The resilient material may include latex foam, polyurethane foam, polypropylene foam, polyethylene foam, or the like and may be used individually or in combination.

In an embodiment, the electric motor vibration facility **118** may use DC or AC current to power the motor. In an embodiment, to provide the vibration, the motor may rotate an offset mass on the motor shaft that may cause the vibration facility **118**, mattress **110**, skeleton structure **114**, or the like to vibrate. The user may feel the vibration through the mattress **110**, springs **108**, or the like.

In an embodiment, an air bladder or air spring may be used to provide a vibration to the adjustable bed facility **102**. In an embodiment, the air bladder or air spring air pressure may be varied at a frequency to create a vibration within the vibration facility **118**, mattress **110**, skeleton structure **114**, or the like. In an embodiment, there may be an air supply unit that supplies the frequency varied air pressure to the air bladder or air spring.

In an embodiment, the vibration motor **118** may be in proximity to a vibration distribution facility that may aid in the propagation of vibration energy to the adjustable bed facility **102** section. In an embodiment, the vibration motor **118** may be operatively connected to the vibration distribution facility, may be in contact with the vibration distribution facility, may not be in contact with the vibration distribution facility, or the like. In an embodiment, the vibration distribution facility may provide for a more uniform distribution of the vibration characteristics of the vibration motor **118** and may have a size and shape relative to the size and shape of the adjustable bed facility **102** section. The vibration distribution facility may be constructed using materials such as plastic, rubber, metal, or the like and may be constructed using these materials individually or in combination. In an embodiment, the user may be able to control the speed, amplitude, pulse, and the like of the vibration facility **118** using an interface such as the remote **148**.

In an embodiment, the vibrator facility **118** may be mounted to the mattress **110** using the vibration distribution facility, resilient material **502**, strong fabric, or the like. In an embodiment, each adjustable bed facility **102** section that includes a vibrator facility **118** may have an opening in the section to accept the vibrator facility **118**. In an embodiment, over the opening in the section, a layer of resilient material **502**, strong fabric, or the like may be placed. The layer of resilient material **502**, strong fabric, or the like may be placed between the vibrator facility **118** and the mattress **110**. In an embodiment, the vibrator facility **118** may impart vibrations to a mattress **110** through the resilient material **502** disposed over an opening in an adjustable bed facility **102** section. In an embodiment, a fabric cover may be disposed over the resilient material **502** and/or an adjustable bed facility **102** section, between the vibrator facility **118** and the mattress **110**. In embodiments, a plurality of fabric covers may be disposed over the resilient material **502** and/or an adjustable bed facility **102** section to provide stabilization. In an embodiment, the vibrator facility **118** may impart vibrations to a mattress **110** through a resilient

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material **502** and a fabric or plurality of fabrics covering the resilient material **502** and/or adjustable bed facility **102** section.

In an embodiment, the resilient material **502** may be foam, cotton matting, or the like. In an embodiment, the vibration distribution facility may be plastic, wood, rubber, metal, or the like and may be any size and/or shape that supports the required vibration characteristics. The vibration distribution facility may have a plurality of barbs or other anchoring devices that may be pushed into the resilient material, strong fabric, or the like to secure the vibration distribution facility in place on top of the resilient material, strong fabric, or the like. In an embodiment, the barbs or other anchoring devices may have a number of gripping edges, points, or the like to provide a connection with the resilient material and strong fabric.

In an embodiment, the vibrator facility **118** may be mounted to the vibration distribution facility through the opening of the adjustable bed facility **102** section lateral surface **508**. In an embodiment, the vibration motor **118** may be operatively connected to the vibration distribution facility, may be in contact with the vibration distribution facility, may not be in contact with the vibration distribution facility, or the like. In an embodiment, there may be a layer of resilient material, strong fabric, or the like between the vibrator motor **118** and the vibration distribution facility.

In an embodiment, any space between the vibration facility **118** and the opening of the adjustable bed facility **102** section may be filled with a vibration absorbent material such as foam, cotton matting, rubber, or the like. The absorbent material may provide a layer of vibration insulation between the vibration facility **118** and the adjustable bed facility **102** section opening.

In an embodiment, the combination of the vibration distribution facility and vibration facility **118** may be a vibration facility assembly. In an embodiment, the vibration facility **118** assembly may be attached to the adjustable bed facility **118** sections with the plurality of barbs or anchoring devices.

Referring again to FIG. 1, in an embodiment, the supports **120** may be hydraulic pressurized cylinders that may provide additional control of the decent of the adjustable bed facility **102** sections. The pressurized supports **120** may be designed to support a certain amount of weight that may include the skeleton structure **114**, mattress **110**, springs **108**, user, and the like. In an embodiment, the pressurized cylinders may be similar to the type of supports that are used in automobile trunks to support the trunk open while the user access the trunk area.

In an embodiment, the supports **120** may provide a safety feature when combined with the safety bracket **112**. The safety bracket **122** may prevent the actuators from forcibly pulling the adjustable bed facility **102** sections down; the safety bracket is described in more detail below. The supports **120** may be positioned on the sections that are actuated and may provide a controlled speed at which the sections will return to a horizontal position. In an embodiment, the support **120** may provide support of a weight that is less than the weight of the section, therefore the section will provide enough force (e.g. weight) on the support **120** to compress the cylinder and move the section down. In an embodiment, there may be more than one support **120** for each actuated adjustable bed facility **102** section. In an embodiment, the support **120** may be connected between the skeleton structure **114** and the sub-frame **112**.

In an embodiment, the safety bracket **122** may be a slotted bracket that provides the connection between the actuators

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104 and the skeleton structure 114 for the purpose of moving the adjustable bed facility 102 sections. A side of the slot that is farthest from the actuator 104 may be the slot first side and may be the side that the actuator 104 pushes on to move the adjustable bed 102 section up. A side of the slot that is nearest to the actuator 104 may be the slot second side and may be the side the actuator 104 pulls on to move the adjustable bed 102 section down. In an embodiment, when the actuator 104 is expanding and moving an adjustable bed facility 102 section it may apply a force on the first side of the slot and move the section in an upward direction. When the actuator 104 is retracted to move the section in a downward direction, the actuator 104 connection may move into the middle area (e.g. not in contact with the first or second side of the slot) of the safety bracket 122 slot. As the actuator 104 connection moves into the slot middle area, the adjustable bed facility 102 section may move in a downward motion under the force of section weight. In an embodiment, the actuator 104 may retract at the same speed as the safety bracket 122 moves, therefore the actuator 104 connection may stay in the safety bracket 122 slot middle area and not make contact with the second side of the safety bracket 122 slot. In this manner, the actuator 104 connection may not contact the second side of the slot and therefore the adjustable bed 102 section may not move in the downward direction by the force of the actuator 104.

In an embodiment, if the actuator 104 connection comes in contact with the second side of the safety bracket 122 slot, there may be a shutoff switch, shutoff indicator, or the like that may stop the retraction of the actuator 104.

In an embodiment, the adjustable bed facility 102 may include an electronic facility 124. In an embodiment, the electronic facility 124 may include a wire harness 128, a receiver 130, power outlets 138, modular controls 132, a power supply 140, a power connection 142, and the like. In an embodiment, different components of the electronic facility 124 may be individual components, combined components, individual and combined components, or the like. For example, the receiver 130, control box 134, and power supplied may be individual components, may be combined into a single component, may be a combination of individual and combined components, or the like. In an embodiment, the various electronic facility 124 components may be mounted on the sub-frame 112, skeleton structure 114, or the like as required for the particular component.

In an embodiment, the wire harness 128 may provide power and data connections to a plurality of modular controls 132. Depending on the power supply 140, the wire harness may provide either DC or AC power to the modular controls 132. In an embodiment, the data connections may be serial, parallel, or the like. In an embodiment, the wire harness may have the same number of power/data connections as there are possible modular controls 132. In an embodiment, the wire harness may be a unit of power/data connections that may be bound together into a single wire harness. In another embodiment, the wire harness may be a group of individual power/data connections. In an embodiment, for each individual wire in the bundle, group, or the like, a first end may have connections for the control box 134 and power supply 140. A second end of the wire harness 128 may be a power and data connection for each individual modular control 132.

In an embodiment, a receiver 130 may receive user commands from a remote control 148. In an embodiment, the receiver 130 may have a wireless or wired connection to the remote 148. In an embodiment, the wireless remote 148 to receiver 130 communication may be a radio frequency

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(RF) communication, infrared (IR) communication, Bluetooth communication, or the like. In an embodiment, the receiver 130 may receive the communication command from the remote 148 and transmit the remote 148 command to the control box 134. The communication with the control box 134 may be wireless or wired. In an embodiment, the wireless communication between the receiver 130 and the control box 134 may be a radio frequency (RF) communication, infrared (IR) communication, Bluetooth communication, or the like. In an embodiment, the receiver 130 may be combined with the control box 134 into a single component. In an embodiment, the skeleton structure 114 may be used as an RF antenna for receiving communication from the remote 148 to the receiver 130. In embodiment, the entire skeleton structure 114 may be used as an antenna; a portion of the skeleton structure 114 may be used as an antenna, or the like.

In an embodiment, the modular controls 132 may provide additional functionality to the adjustable bed facility 102 that may include a stereo, a CD player, an MP3 player, a DVD player, a lamp, power outlets 138, an air purification facility 144, or the like. The additional functionality that the modular controls 132 provide may be considered optional equipment that may be offered with the adjustable bed facility 102. For example, a user may be able to purchase an adjustable bed facility 102 without any modular controls 132 and may add modular controls as he or she desires. In another example, the user may purchase the adjustable bed facility 102 with modular controls already installed. In an embodiment, the modular controls 132 may have predetermined mounting locations on the sub-frame 112, skeleton structure 114, or the like.

In an embodiment, the modular controls 132 may directly control devices, indirectly control devices, or the like. For example, the modular control 132 may directly control a lamp that is connected to the modular control 132 but may indirectly control a device or facility that is plugged into an outlet 138 controlled by the modular control 132. The devices and facilities may include a stereo, CD player, DVD player, air purification facilities, or the like may receive power from power outlets 138 that are controlled by the modular control 132. In this example, the user control of the power outlet 138 to turn the device on or off but the user may not be able to control the individual device (e.g. the volume of stereo). In an embodiment, the user may control the additional function devices by using the remote 148 that may have an interface for each of the modular controls 132. For example, there may be an interface on the remote 148 for turning on a lamp, turning off a lamp, dimming a lamp, and the like. In a similar manner, the user may be able to control if a power outlet 138 provided by a modular control 132 is on or off.

In an embodiment, the modular controls 132 may be connected to the control box 134, power supply 140, or the like; the connection may be the wire harness 128. In an embodiment, the modular controls 132 may communicate with the control box 134 by a wireless means that may include radio frequency (RF), infrared (IR), Bluetooth, or other wireless communication type.

In an embodiment, the control box 134 may interpret commands received from the receiver 130 into commands for the various adjustable bed facility 102 components such as the actuators 104, the vibration facility 118, the modular controls 132, power outlets 138, and the like. In an embodiment, the control box 134 may contain a microprocessor, microcontroller, or the like to run a software application to interpret the commands received from the remote 148

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through the receiver **130**. In an embodiment, the software application may be interrupt based, polling based, or other application method for determining when a user has selected a command on the remote **148**. In an embodiment, the software application may be stored in the control box **134**, stored in bed memory **154**, or the like and may be stored as software, as firmware, as hardware, or the like.

In an embodiment, the control box **134** may receive information from the receiver **130** by wired communication, wireless communication, or the like. In an embodiment, the wireless communication may be by radio frequency (RF), infrared (IR), Bluetooth, or other wireless communication type.

In an embodiment, after the control box **134** has interpreted the received user commands, the control box **134** may transmit the interpreted commands to the various controllers for the adjustable bed facility **102** components such as the actuators **104**, vibrator facility **118**, modular controls **132**, power outlets **138**, and the like. The control box **134** may transmit information that may be further interpreted by the components into commands for the individual components. For example, the control box **134** may receive a command to move the head section up. The control box **134** may interpret the remote **148** command into a command the actuator may understand and may transmit the command to extend the head section actuator to move the head section up.

In an embodiment, the power supply **140** may receive power from a standard wall outlet, fuse box, circuit box, or the like and may provide power to all the powered components of the adjustable bed facility **102**. In an embodiment, the power supply **140** may provide DC power or AC power to the components. In an embodiment, if the power supply **140** provides DC power, the power supply **140** may convert the incoming AC power into DC power for the adjustable bed facility **102**.

In an embodiment, the power outlets **138** may provide standard household AC current using a standard outlet for use by external devices using a standard plug. In an embodiment, the power outlets **138** may receive power directly from a standard wall outlet, a fuse box, a circuit box, or the like, but the control box **134** may control whether the power outlet **138** on or off. In an embodiment, the power outlet **138** may have a control circuit that may determine if the power outlet **138** is active (on) or inactive (off). In an embodiment, the command to indicate if the power outlet **138** is active or inactive may be received from the control box **134**. In an embodiment, the control box **134** may receive commands for the power outlet **138** control from the remote **148**.

In an embodiment, the power connection **142** may receive standard power for the adjustable bed facility **102** from a standard outlet, fuse box, circuit box, or the like. In an embodiment, the power connection **142** may provide standard AC power to the power outlets **138**, the power supply **140**, or the like.

In an embodiment, the air purification facility **144** may be any type of device or facility that may be capable of improving that air environment in the area of the adjustable bed facility **102**. In an embodiment, the air purification facility **144** may be an absorbent type (e.g. carbon), electro-static, HEPA filter, or the like. In an embodiment, absorbent materials may be used in a filter, in the adjustable bed facility **102**, in the mattress **110**, or the like to absorbed odor, dust, contaminants, or the like from the air environment around the bed, within the bed, or the like. In an embodiment, electro-static or ionic air filters may use negative ions to attract dust, contaminants, and the like from the air. In an

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embodiment, electro-static materials (e.g. tourmaline) may be used in a filter, in the adjustable bed facility **102**, in the mattress **110**, or the like to absorbed odor, dust, contaminants, or the like from the air environment around the bed, within the bed, or the like. In an embodiment, HEPA filters are composed of a mat of randomly arranged fibers that are designed to trap at least 99.97% of dust, pollen, mold, bacteria, and any airborne particles with a size of 0.3 micrometers (μm) at 85 liters per minute (Lpm). The HEPA filter may be used in a device, facility, or the like for filtering the air in the area of the adjustable bed facility **102**.

In an embodiment, the air purification facility **144** may be part of the adjustable bed facility **102**, a freestanding device or facility, or the like. In an embodiment, if the air purification facility **144** is part of the adjustable bed facility **102** the air purification facility **144** may be attached to any part of the adjustable bed facility **102** such as the mattress **110**, sub-frame **112**, skeleton structure **114**, or the like. In an embodiment, the air purification facility **144** that is attached to the adjustable bed facility **102** may be controlled direct control of the air purification facility **144**, control using the remote **148**, or the like.

In an embodiment, the air purification facility **144** may be a free standing device that may be plugged into an adjustable bed facility **102** power outlet **138** and therefore may be controlled with the remote **148** controlling the on/off condition of the power outlet **138**.

In an embodiment, the air purification facility **144** may be a freestanding device that may be connected to an adjustable bed facility **102** modular control **128**. The modular control may provide power (AC or DC), control communication, and the like to the air purification facility **114**. In an embodiment, the user may be able to control the air purification facility **144** using the remote **148** to control the modular controls **132**.

In an embodiment, the remote **148** may be a user controlled device to provide control commands to the control box **134** to command certain functions of the adjustable bed facility **102**. In an embodiment, the certain functions may be adjustable bed facility section movement (e.g. up or down), vibration control, modular controlled **132** devices, or the like. In an embodiment, the remote **148** may communicate with the control box using wired communication, wireless communication, or the like. In an embodiment, the wireless communication may be using a radio frequency (RF), infrared (IR), Bluetooth, or the like. If the remote communicates using a wireless technology, the communication may be with the receiver **130** and the receiver **130** may pass the command request to the control box **134**.

In an embodiment, the user may indicate the certain adjustable bed facility **102** function using the remote **148** by pressing a button, touching a screen, entering a code, speaking a command, or the like. In an embodiment, the control box **134**, using the receiver **130**, may receive and interpret the command provided by the remote **148**. In an embodiment, the certain functions available on the remote may instruct the control box **134** to directly control a device (e.g. actuator **104**), control a modular control **132** connected device, or the like. The remote may control devices with commands that may include on, off, high power, medium power, low power, volume, play, fast forward, rewind, skip, modular device to control, or the like. For example, the remote **148** may transmit a command to move the head section up and the control box **134** may command the actuator **104** to extend a certain amount in response to the command. In another example, the remote **148** may com-

mand that a modular control **132** connected lamp be turned off. The control box **134** may command the control box **132** to turn off the lamp.

In an embodiment, the remote **148** may save adjustable bed facility **102** user preferred settings to a plurality of memory locations that may be used to maintain the user determined bed position, an adjustable bed facility **102** historical setting, or the like. For example, the user may have a certain preferred adjustable bed facility **102** position that may be stored in at least one of the memory locations that the user may be able to later recall to move the adjustable bed facility into the user preferred position. By indicating the recall of the at least one memory locations, the adjustable bed facility **102** control box **134** may command the various components to move to the stored memory location position to achieve the recalled position. In an embodiment, for a remote **148** that may contain buttons, the user may press a single button, a combination of buttons, or the like to recall the memory position desired.

In an embodiment, the remote **148** may have buttons, an LCD screen, a plasma screen or the like to allow the user to indicate the desired command. In an embodiment, the user may press a button to indicate a command to the control box **134**. In an embodiment, the LCD or plasma screens may be touch screen sensitive. In an embodiment, the remote **148** screen may present the available controls to the user and the user may touch the screen to indicate the command desired. For example, the remote **148** screen may only present controls that are available in the adjustable bed facility **102**; therefore if a modular control **132** is not available, the remote **148** may not display a selection for that modular control **132**. In an embodiment, the remote **148** screen may present content sensitive selections to the user. For example, if the user selected to control a CD player, the user may be presented with CD player controls that may include play, fast forward, rewind, skip, stop, repeat, or the like.

In an embodiment, the remote **148** may provide feedback to the user to indicate the success of the certain command. In an embodiment, the feedback may be an audio feedback, a visual feedback, a forced feedback, or the like. In an embodiment, the feedback types may be used individually or in combination. In an embodiment, the audio feedback may be a sound that indicates that the command was successful, failed, is in progress, in conflict with a command in progress, failed for safety reasons, or the like. In an embodiment, the visual feedback may be an indication of the remote **148** screen that indicates that the command was successful, failed, is in progress, in conflict with a command in progress, failed for safety reasons, or the like. In an embodiment, the forced feedback may be a vibration that indicates that the command was successful, failed, is in progress, in conflict with a command in progress, failed for safety reasons, or the like.

In an embodiment, a memory facility **150** may contain components that are intended to maintain certain memory locations for the control box to access, receiver to access, and the like. In an embodiment, the memory facility **150** may include a receiver learn facility **152**, a bed memory **154**, a backup battery **158**, and the like. In an embodiment, the receiver learn facility **152**, bed memory **154**, and backup battery **158** may be in a single memory facility **150** or may be in more than one memory facilities **150**. In an embodiment, the memory facility **152** may be part of the adjustable bed facility **102**, part of the electronic facility **124**, a separate facility, or the like. In an embodiment, the receiver learn facility **152**, bed memory **154**, and backup battery **158** may

not be part of the memory facility **150**, but may be combined into other facilities or devices, be stand-alone devices, or the like.

In an embodiment, the receiver learn facility **152** may act to establish the communication link between the remote **148** and the receiver **130** where the communication between the remote **148** and receiver **130** is a wireless connection. In an embodiment, the communication link between the remote **148** and the receiver **130** may need to be a unique connection to assure that the remote **148** communicates with only one receiver **130** within one adjustable bed facility **102**. In an embodiment, the receiver learn facility **152** may be used to provide a unique communication between any remote **148** and any adjustable bed facility **102**. For example, a remote **148** may be used to communicate with a first adjustable bed facility **102** and may be used to establish communication between the same remote and a second adjustable bed facility **102**. The remote **148** may only be able to communicate with one adjustable bed facility **102** at a time.

In an embodiment, a learn protocol between the remote **148** and receiver **130** may be user initiated by pressing a button on the receiver learn facility **152**, powering up the receiver learn facility **152**, bringing the receiver learn facility **152** within a certain proximity of the receiver **130**, indicating on the remote **148** to begin the learn protocol, or the like. In an embodiment, the learn protocol may be fully automatic, semi-automatic with user intervention, manual, or the like. In an embodiment, a user may select a channel, frequency, or the like during learn protocol or after the learn protocol. The changing of the channel, frequency, or the like may prevent two different remote **148** and receiver **130** combinations from interfering with other wireless communication devices. In an embodiment, each time the learn protocol is executed, a new unique communication link may be established; there may be a plurality of unique communication links available for each remote **148** and receiver **130** combination.

In an embodiment, the bed memory **154** may be the memory location where the control box **134** stores user desired preset information, software for interpreting remote **148** commands, demonstration software, and the like. In an embodiment, the bed memory **154** may be removable memory. For example, the bed memory **154** may be moved from a first adjustable bed facility **102** to a second bed facility **102** to move user settings from the first adjustable bed facility **102** to the second bed facility **102**. In this manner the bed memory **154** may be considered portable memory. In an embodiment, the removable bed memory **154** may be flash memory, programmable logic circuit (PLC) memory, secure digital (SD) memory, mini SD memory, Compact Flash type I memory, Compact Flash type II memory, Memory Stick, Multimedia Card, xD Picture card, Smartmedia, eXtreme Digital, Microdrive, or the like.

In an embodiment, the removable bed memory **154** may be used to upgrade the adjustable bed facility **102** memory and software. For example, if new control box **134** software was developed to provide better control over one of the adjustable bed facility **102** components, the software may be saved to a new replaceable memory that may be used in the place of the existing replaceable memory. In this manner, the software of the adjustable bed facility **102** could be upgraded just by providing the user with a new replaceable memory.

In an embodiment, the removable memory may be used to provide a sales enterprise with adjustable bed facility **102** demonstration software where the enterprise may be able to indicate at least one of a plurality of demonstrations for a

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user. For example, the user may be interested in how the adjustable bed facility 102 sections may be adjusted and the enterprise may select a demonstration to shows all the section motion available. In an embodiment, before an adjustable bed facility 102 is shipped to a user, the enterprise may remove the demonstration removable memory and replace it with a standard adjustable bed facility 102 bed memory 154.

In an embodiment, the backup battery 158 may be used to provide power to volatile memory, provide power to the receiver learn facility 152, provide power to the programmable logic circuit (PLC) memory, or the like.

In an embodiment, the memory connection 160 may be any connection type that provides a connection between the bed memory 154, control box 134, and the like. In an embodiment, the memory connection 160 may be a wired or wireless connection. The wired connection may be a USB connection, a serial connection, parallel connection, or the like. The wireless connection may be by radio frequency (RF), infrared (IR), Bluetooth, or the like. In an embodiment, the memory connection 160 may be in a location that is easy for the user to access the bed memory 154, may be attached to the memory facility 150, may be attached to the control box 134, or the like. In an embodiment, the easy access memory connection may be on the side of the adjustable bed facility 102, on a rail of the adjustable bed facility 102, under the adjustable bed facility 102, or the like.

In an embodiment, the network connection 162 may be used to connect the control box 134 to a network connection. In an embodiment, the network connection may be a LAN, a WAN, an Internet, an intranet, peer-to-peer network, or the like. Using the network connection 162, the control box 134 may be able to communicate with computer devices on the network. In an embodiment, the network connection 162 may be a wired or wireless connection.

In an embodiment, using the network connection 162, the control box 134 may be able to communicate with the network to periodically check for software updates. In an embodiment, if a software update is located, the control box 134 may send the user an email, instant messenger message, phone message, phone call, cell phone message, cell phone call, fax, pager message, or the like to indicate that software updates are available. The user, using the device that received the notice of software, may send a reply to the control box that the software upgrade should be downloaded, should not be downloaded, or the like.

In an embodiment, an adjustable bed facility 102 enterprise, an adjustable bed facility 102 manufacturer, an adjustable bed facility 102 service enterprise, or the like may send the control box 134 software updates using the network connection 162. In an embodiment, an adjustable bed facility 102 enterprise, an adjustable bed facility 102 manufacturer, an adjustable bed facility 102 service enterprise, or the like may notify the user of available software upgrades for the adjustable bed facility 102 by email, instant messenger message, phone message, phone call, cell phone message, cell phone call, fax, pager message, or the like. The user, using the device that received the notice of software, may send a reply to the adjustable bed facility 102 enterprise, the adjustable bed facility 102 manufacturer, the adjustable bed facility 102 service enterprise, or the like that the software upgrade should be downloaded, should not be downloaded, or the like.

Referring now to FIG. 4A and FIG. 4B, an embodiment of shipping and assembling a mattress retaining bracket 402 is shown. The mattress retaining bracket 402 may be used to hold the mattress 110 (not shown) in place on the adjustable

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bed facility 102 as the adjustable bed facility 102 sections are adjusted. For example, as the head section is adjusted up, the mattress 110 may tend to slide down towards the foot of the bed; the mattress retaining bracket 402 may stop the mattress from sliding and may maintain the mattress 110 in the proper position on the adjustable bed facility 102. In an embodiment, there may be a mattress retaining 402 bracket at the head section and/or the foot section of the adjustable bed facility 102.

In an embodiment, the mattress retaining bracket 402 may be made of materials that include metal, plastic, rubber, wood, or the like. In an embodiment, the materials may be used individually or in combination.

In an embodiment, as shown in FIG. 4A, when the adjustable bed facility 102 is shipped to the user, the mattress retaining bracket 402 may be mounted upside down at the final location of the mattress retaining bracket 402. This mounting method may provide benefits that may include mattress retaining bracket 402 breakage prevention, mattress retaining bracket 402 bending prevention, clear user understanding of the final mattress retaining bracket 402 location, prevention of the mattress retaining bracket 402 becoming lost, and the like. In an embodiment, as shown in FIG. 4B, once the user receives the adjustable bed facility 102 with the upside down mounted mattress retaining bracket 402, the user may rotate the mattress retaining bracket 402 into the upright position and re-secure it to the adjustable bed facility 102.

Referring to FIG. 6, an example of an adjustable bed 600 (without the mattress) is shown with the head 602 and foot 604 sections raised to an elevated position. This adjustable bed 600 shows that sections, in this case the foot 604 section may be divided into more than one section to provide contouring of bed sections.

Referring to FIG. 7, an example of actuators 104 connected to the bed frame 702 and the adjustable sections 704 is shown. In this case two actuators 104 are used, one for each adjustable bed section 704.

Referring to FIG. 8, an example of more than one actuator 104 for each adjustable bed section 802 is shown, in this case there are two actuators 104 for each adjustable section 802. In embodiments, more than one actuator 104 per section 802 may be used if the bed sections 802 are heavy, smaller actuators 104 are used, if the bed is a wide bed (e.g. king bed), or the like.

Referring to FIG. 9, an example of an adjustable bed 900 using slats 902 instead of wood decking for the foundation of the adjustable sections is shown. In embodiments, the slats 902 may be wood, plastic, rubber, cloth, elastic material, or the like. Using this design, the adjustable bed 900 may be provided with curved contours has shown in the head section 904. In an embodiment, the curved sections may be constructed of a number of small connected individual sections.

An adjustable bed may be constructed in a variety of ways, including distinct functional frame assemblies that are functionally connected to each other and/or to a base frame. The distinct frame assemblies may allow for separate controlled movement and positioning of portions of the adjustable bed to enhance user comfort. The adjustable bed embodiments of FIGS. 15 through 19 include various features that provide independent adjustability, ease of assembly, wheeled movement of the bed, and other capabilities through the use of an assembly of distinct frame assemblies.

Referring to FIG. 15 which depicts portions of an adjustable bed frame assembly, the adjustable bed frame assembly 1500 includes a center frame 1502 comprising two substan-

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tially parallel side frame members **1504** connected by two substantially parallel connector frame members, a forward connector frame member **1508A** and a rear connector frame member **1508B**, wherein the two connector frame members **1508A** and **1508B** are located within approximately a center one-third of the length of the side frame members **1504**. The adjustable bed frame assembly **1500** also includes a base frame **1510**, a portion of which is shown in FIG. **15**, that includes a plurality of legs **1512** for mounting on a floor is rigidly affixed **1514** to the center frame **1502** such that the center frame **1502** does not move with respect to the base frame **1510**. The adjustable bed frame assembly **1500** further includes a head frame **1518** that comprises two substantially parallel side frame members **1520** connected by a pair of connector frame members **1528A** and **1528B**, wherein a lower end of each of the head frame's parallel side frame members **1520** are pivotally attached to the forward connector frame member **1508A** of the center frame **1502**. In addition, a downwardly facing extension frame member **1522** is attached to connector frame member **1528A**. The adjustable bed frame assembly **1500** also includes an actuator **1524** for raising and lowering the head frame **1518**, wherein one end of the actuator **1524** is pivotally connected to the head frame's extension frame member **1522** and an opposing end of the actuator **1524** is connected to the center frame's rear connector frame member **1508B**. The adjustable bed frame assembly **1500** also includes a mattress platform (not shown in FIG. **15**) affixed to a top side of the head frame **1518** to provide support to a head portion of a mattress (also not shown in FIG. **15**). The adjustable bed frame assembly **1500** may be made of tubular construction with a round profile, square profile, oblong profile, and the like. Alternatively the frame assembly **1500** may be made of angle iron, u-channel, I-beam, and other metal fabrication shapes. Any and all shapes may be used on various frame elements in various combinations to assemble the frame assembly **1500**.

In operation, the actuator **1524** may retract to raise the head frame **1518** and may extend to lower the head frame **1518**. When extended, the adjustable bed frame assembly **1500** provides a substantially horizontal plane for supporting a mattress. An angle between the base frame **1510** and the head frame **1518** is approximately 180 degrees. During retraction of the actuator **1524**, the pivot connections between the head frame's parallel side frame members **1520** and the forward connector frame member **1508** causes the head frame **1518** to move relative to the base frame **1510** resulting in the angle being formed between the head frame **1518** and the base frame **1510** to decrease below 180 degrees. Extending the actuator **1524** causes the angle to increase until the angle is approximately 180 degrees again.

The actuator **1524** may be controlled through a programmable logic controller. Alternatively a programmable logic controller (PLC) executes actuator control as indicated through receipt of a user remote control instruction. The mattress platform may be made of wood.

Referring to FIGS. **16A**, **16B**, **16C**, **16D**, and **16E** which depict various orthogonal views of an embodiment of an adjustable bed, the adjustable bed frame assembly **1500** may be fitted with a flexible mattress platform **1602**, shown in FIG. **16A**. The flexible mattress platform **1602** may be surrounded by fixed position skirt panels **1604** which may be rigidly attached to the center frame **1502**, the base frame **1510**, or a combination thereof. In operation, as the actuator **1524** extends and the head frame **1518** pivots in relationship to the base frame **1510**, the flexible mattress platform **1602** flexes substantially along the axis of the forward connector

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frame member **1508A**. A mattress stop **1604** may be secured to one of the skirt panels **1604** that is opposite the head frame **1518**. The mattress stop **1604** may keep a mattress that is placed on top of the flexible mattress support **1602** from being unintentionally repositioned by the operation of the actuator **1524**. An exemplary top view **1610** is shown. FIG. **16B** includes a bottom view **1608**. FIG. **16C** includes a head view **1612**. FIG. **16D** includes a side view **1614**. FIG. **16E** includes a foot view **1618**. In an alternative configuration of the adjustable bed depicted in FIG. **16A**, the flexible mattress support **1602** and the skirt panels **1604** may be co-joined to form a rigid mattress support that substantially inhibits adjustability of the bed frame.

Also depicted in FIG. **16B**, base frame **1510** may include lateral support members **1624**, **1628**, and **1630**.

FIGS. **17A**, **17B**, **17C**, **17D**, **17E**, and **17F** show exemplary depictions of various orthogonal views of an embodiment of an adjustable bed that may be an adaptation of the adjustable bed depicted in FIGS. **16A**, **16B**, **16C**, **16D**, and **16E**. The adjustable bed frame assembly **1500** may be fitted with substantially parallel and co-planar separated mattress platform panels including a head panel **1702**, as shown in FIG. **17A**, that may be attached to the head frame **1518**, a seat panel **1704**, as shown in FIG. **17B**, that may be attached to the center frame **1502**, and two leg panels **1708** and **1710** that may be pivotally attached together along an edge. Leg panel **1708** may be pivotally attached along an edge that is opposite to the edge along which it is attached to leg panel **1710** to the center frame **1502** and in close proximity to the seat panel **1704**. Additionally leg panel **1708** may be driven by an actuator **1712**, shown in FIG. **17E**, that is attached at one end to the center frame **1502** and at the other end to a leg frame **1714**, shown in FIG. **17F**. Leg panel **1710** may also be pivotally connected to leg panel riser members **1718** close to the edge that is opposite the edge to which leg panel **1708** is connected. The actuator **1712** and leg panel riser members **1718** operate cooperatively to enable the leg panels to rise up to form a shape that allows the legs of a user of the adjustable bed to be elevated while keeping the user's knees bent. The result is the leg panels **1708** and **1710** support a user's legs between the hip and knee at a greater vertical incline than the user's legs between the knee and foot. In operation, actuator **1712** may extend, causing leg panel **1708** to pivot around the connection to center frame **1502** resulting in the leg panel **1708** forming an angle with seat panel **1704** less than 180 degrees. Pivotal connections between leg panel **1708** and **1710** work cooperatively with the pivotally connected leg panel riser member **1718** to cause leg panel **1710** to elevate in response to leg panel **1708** pivoting. In elevation, leg panel **1710** may remain close to horizontal with the edge that connects to leg panel **1708** being slightly more elevated than the opposite edge. In the embodiment of the adjustable bed of FIGS. **17A-F**, the elements depicted and described for the adjustable bed of FIGS. **16A-E** may apply with the exception of the flexible mattress **1602** and the fixed skirt panels **1604**. FIG. **17C** includes a bottom view **1720**. FIG. **17B** includes a top view **1722**. FIG. **17D** includes a head view **1724**. FIG. **17E** includes a side view **1728**. FIG. **17F** includes a foot view **1730**.

Leg frame **1714** may include thigh tube **1734** to which actuator **1712** is connected through a drive arm. Thigh tube **1734** extends laterally across the bed to connect opposing parallel longitudinal leg frame **1714** members. Extending longitudinally from thigh tube **1734** to lateral leg frame member **1738** are two foot support members **1732**.

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FIGS. 18A-F depicts the adjustable bed of FIGS. 17A-F with head, seat, and leg panels in a substantially horizontal common plane. This may be accomplished by extending actuator 1524 and retracting actuator 1712. FIG. 18A includes a bottom view 1820. FIG. 18B includes a top view 1822. FIG. 18C includes a head view 1824. FIG. 18D includes a side view 1828. FIG. 18E includes a foot view 1830. FIG. 18F includes a raised angular view 1832.

FIGS. 19A-F depict the adjustable bed of FIGS. 17A-F with skirt panels attached to outer edges of the head panel 1702, seat panel 1704, and leg panels 1708 and 1710. The skirt panels, as depicted, may enhance visual appearance and provide a barrier to the user from easily accessing the frame members and actuators. FIG. 19A includes a bottom view 1920. FIG. 19B includes a top view 1922. FIG. 19C includes a head view 1924. FIG. 19D includes a side view 1928. FIG. 19E includes a foot view 1930. FIG. 19F includes a raised angular view 1932.

FIG. 20 depicts a detail of a portion of the bed frame 1500 that facilitates movement of either the head frame 1518 or the leg frame 1714 when the actuator is operated. Although the embodiment of FIG. 20 includes references for a head frame 1518 use, the same configuration can be used for facilitating movement of the leg frame 1714. In particular, an actuator bracket 2002 is connected to frame connector bracket 1528B. Downwardly facing extension frame member 1522 is rigidly connected to frame connector bracket 1528A at one end and the actuator bracket 2002 at the other. As actuator 1524 extends, actuator bracket 2002 applies a force to connector frame bracket 1527B and to downwardly facing extension frame member 1522 that transfers the force to connector frame bracket 1528A resulting in head frame 1518 rotating around the pivotable connection 2004 made by parallel side frame members 1520 and forward connector frame member 1508A.

FIG. 21 depicts the operation of bracket 2002 through various extension positions of actuator 1524. Based on extension position of actuator 1524, head frame 1518 may be positioned in any position. Three representative positions 2102, 2104, and 2108 are depicted in FIG. 21.

FIG. 22 depicts an alternate embodiment of the adjustable bed frame assembly that incorporates many of the frame elements of FIGS. 15-21 wherein center lateral member 1628 is removed and diagonal support members 2202 and 2204 are added. Diagonal support member 2202 is connected at one end to a first side rail of base frame 1510 midway between lateral supports 1624 and 1630 and is connected at an opposite end to approximately the center of lateral support member 1624. Diagonal support member 2204 is connected at one end midway between lateral supports 1624 and 1630 to a second side rail of the base frame 1510 that is opposite the first side rail and at the opposite end to approximately the center of lateral support member 1630. Castors 2208 and 2210 are positioned approximately below the connection of each diagonal support member and each side rail of the base frame. The embodiment of FIG. 22 further includes actuator bracket 2002 assembled as described with respect to FIGS. 20 and 21.

FIG. 22 also shows actuators 1524 and 1712 positioned close to a center line of the bed to at least reduce the potential for rotational torque applied to an extending actuator. The centerline position of the actuators also enables control electronics 2212 to be positioned away from the center of the bed, thereby improving serviceability. In addition to eliminating center lateral support 1628, the adjustable bed frame of FIG. 22 also has a simplified foot frame 1714

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that eliminates both foot support members 1732 and reduces the length of lateral thigh tube 1734 by approximately one-half.

FIG. 23A, FIG. 23B, FIG. 24, FIG. 25, FIG. 26, FIG. 27, FIG. 28, FIG. 29, FIG. 30, FIG. 31, FIG. 32A, FIG. 32B, FIG. 32C, FIG. 32D, FIG. 32E, FIG. 32F, and FIG. 32G all depict embodiments of an adjustable bed where only the head portion articulates. In certain embodiments described with respect to these figures, a truss is included for reinforcing the structure, however, embodiments of the adjustable bed where only the head portion articulates may not require a truss for stability, such as in FIG. 25. The adjustable bed in these embodiments resembles a flat foundation, however, in this case, a head board portion of the base frame can pivot when commanded to do so to raise a head portion of a mattress placed on top of the adjustable bed. The head board portion may pivot along a pivot point that may be in a top one-third of the base frame. In other embodiments, the head board portion may pivot along a pivot point that may be in a center one-third of the base frame. The base frame may form a box that completely encloses the adjustable mechanism for the bed including the center frame, head frame, actuator, and the like. In embodiments, the base frame may be made from wood. The base frame may be covered with fabric. Additionally, the head board portion of the base frame may also be covered with fabric. In its articulated position, fabric may conceal all of the inner workings of the adjustable bed, as shown in FIG. 28. In embodiments, foam may be disposed along the perimeter of the head board portion to cushion the interface of the head board with the surface of the base frame. In embodiments, the actuator may be a push-only motor to elevate the head board portion. In order to return to a flat position, the user may need to exert a pressure on the head board.

FIG. 23 depicts an alternate embodiment of the adjustable bed frame assembly with a truss-reinforced structure. In an embodiment, a steel skeleton may be disposed under the head and center of the adjustable bed facility 102. In an embodiment, the adjustable bed facility 102 may comprise a truss. The truss may be formed from at least two truss members that may be crossed to form an X shape. The truss may be disposed between the upper frame 2310 of the adjustable bed facility and the lower frame 2312 of the adjustable bed facility 102. For example, the truss may connect to the steel skeleton 114 and the foundation materials, such as oriented strand board (OSB), plywood, and the like, of the adjustable bed frame, which may comprise a bed deck 2304, head board 2318, upper frame 2310, lower frame 2312, and middle section 2314 (also known as center frame elsewhere). The truss members may be fastened together in the center of the X to give it more strength. The truss may box in a key area of the adjustable bed facility 102 and enable the adjustable bed facility 102 to support large amounts of weight.

In an embodiment, the adjustable bed facility 102 frame could be built with legs or without legs on the corners. If the adjustable bed facility 102 lacks legs, it can rest on a standard steel foundation 2308. Some steel foundations provide more support than others depending on where the crossbars are located, but the adjustable bed facility 102 may be operable with most steel foundations.

In an aspect, an adjustable bed facility 102 may comprise standard flat foundation materials. For example, the adjustable bed facility 102 may comprise wood strapping and 2x4s. In an alternative embodiment, the adjustable bed facility 102 may be made from any material, such as metal, steel, plastic, wood, fiberglass, and the like.

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The adjustable bed facility 102 may support considerable weight. For example, in FIG. 23A, the head board 2318 is supporting 400 pounds of weight and in FIG. 23B, the head board 2318 of the adjustable bed facility 102 is supporting 400 pounds of weight and the bed deck 2304 is supporting 350 pounds. As can be seen in FIG. 23B, the adjustable bed facility 102 rests on and is supported on a standard steel foundation 2308. The truss 2402 may be disposed in the middle section 2314 between the lower frame 2312 and the upper frame 2310/bed deck 2304. The truss may be oriented such that the X shape formed by the truss is oriented along the length of the adjustable bed facility 102. In some embodiments, the truss 2402 may be oriented along the width of the adjustable bed facility 102. In some embodiments, the truss 2402 may be disposed anywhere along the bed deck 2304 portion of the adjustable bed facility 102. The truss 2402 may be connected to the skeleton 114, the bed deck 2304, the upper frame 2310, lower frame 2312, middle section 2314, or any combination thereof. In some embodiments, the actuator 104 may also be connected to the truss 2402.

In operation, when the adjustable bed facility is fully extended, the head board 2318 rests on the upper frame 2310 of the adjustable bed facility. When the adjustable bed facility 102 is operated, the head board 2318 may lift away from the upper frame 2310. For example, the head board 2318 and bed deck 2304 may be hinged or otherwise connected such that the head board 2318 is pivotally connected to the bed deck 2304. In some embodiments, the upper frame 2310, lower frame 2312, and bed deck 2304 may remain motionless. In other embodiments, the bed deck 2304 may be divided into a center frame and a leg frame portion so that there may be additional motions possible for the adjustable bed facility 102. In an embodiment, when the skeleton 114 is connected to the truss 2402, the weight of a user against the head board 2318 and bed deck 2304, either in the fully extended or head board-lifted positions, are more supported than if no truss 2402 were present.

Referring to FIG. 24, the truss 2402 is disposed between the upper frame 2310 and lower frame 2312 of the adjustable bed facility. In an embodiment, the truss is secured to both the upper frame 2310 and lower frame 2312 using a fastener, such as a screw, nail, bolt, staple, and the like. In some embodiments, the truss 2402 is secured to the bed deck 2304 as well.

Referring to FIG. 25, the adjustable bed facility 102 may comprise a skeleton 114. The skeleton 114 may provide structural support for the adjustable bed facility 102 and the physical connection between the head board 2318 and the lift facility (not shown). The skeleton 114 may be secured to the head board 2318 through certain attachment points, and secured to the middle section 2314, bed deck 2304, upper frame 2310 and/or lower frame 2312 using a fastener, such as a screw, nail, bolt, staple, and the like. The truss 2402 may be part of the skeleton 114. In FIG. 25, the adjustable bed facility 102 is shown in the lifted position, with the skeleton 114 attached to at least the head board 2318 and the middle section 2314. FIG. 26 shows an alternate angle of the adjustable bed facility 102 in a lifted position. The head frame portion of the skeleton attached to the head board 2318 includes parallel side frame members 2604 and a connecting frame member 2602. The head frame portion of the skeleton 114 may be pivotally connected 2608 to the skeleton 114 in a center portion of the bed. In embodiments, the connecting frame member 2602 may extend the width of the head board 2318.

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Referring to FIG. 27, the truss-reinforced adjustable bed facility 102 is shown with a mattress cover. The adjustable bed frame is covered with a mattress fabric. Additionally, the bed deck 2304 and head board 2318 may be additionally covered in a mattress cushioning for the user's comfort. In FIG. 27A, the head board 2318 is fully extended. In FIG. 27B, the head board 2318 has been lifted, as has been described herein. The head board 2318 lifts away from the upper frame 2310. For example, the head board 2318 and bed deck 2304 may be hinged such that the head board 2318 rotates around the axis of the hinges while the upper frame 2310, lower frame 2312, and bed deck 2304 remain motionless. In FIG. 27, the head board 2318 has its own covering so that when it lifts, the portion of the adjustable bed facility 102 that remains motionless is also covered. This may also be seen in an alternate view of the head board 2318 lifted position in FIG. 28.

The truss reinforced adjustable bed facility 102 may comprise any number of components described herein, such as actuators 104, springs 108, mattresses 110, a sub-frame 112, a skeleton structure 114, vibration motors 118, supports 120, safety brackets 122, an electronic facility 124, an air purification facility 144, a remote 148, a memory facility 150, a memory connection 160, a network connection 162, and the like. In an embodiment, the electronic facility 124 may include a wire harness 128, a receiver 130, modular controls 132, a control box 134, power outlets 138, a power connection 142, and the like. In an embodiment, the memory facility 150 may include a receiver learn facility 152, bed memory 154, a backup battery 158, and the like. In an embodiment, the receiver learn facility 152, bed memory 154, and backup battery 158 may not be part of the memory facility 150, but may be combined into other facilities or devices, be stand-alone devices, or the like. In an embodiment, the physical aspects of the truss-reinforced adjustable bed facility 102 that provide support for the user may include the actuators 104, springs 108, mattresses 110, a sub-frame 112, a skeleton structure 114, vibration motors 118, supports 120, and safety brackets 122.

Referring to FIG. 29, a view of the truss 2402 is shown looking down the center of the adjustable bed frame lengthwise. The truss 2402 is attached to the middle section 2314, between the lower frame 2312 and the upper frame 2310/bed deck 2304.

Referring to FIG. 30, looking down the center of the adjustable bed frame width-wise, the truss 2402 is fastened to at least two places on the skeleton 114 and to the middle section 2314 of the adjustable bed frame. An actuator 104 is shown in the foreground, partially obstructing the view of the truss 2402. Referring to FIG. 31, the truss 2402 is now seen from the opposite side of the adjustable bed frame, still looking down the center width-wise. The fastener at the center of the X structure of the truss 2402 is clearly visible in this view.

In embodiments, referring to FIG. 32A and FIG. 32B, structural views of the adjustable bed facility 102 may be provided. The adjustable bed facility may have a mattress support section 3208 and a truss 2402. As shown in FIG. 32C, the mattress support section may have a screw 3210 to tighten/loosen the mattress retained by bar 3202. In embodiments, the screw may be a wooden screw 3212. In addition, a foot and back deck 3204 is also represented in the FIG. 32C. Moreover, FIG. 32C represents a rail 3230, rail 3232, foam 3228, cross bars 3234, decks 3224, and the like. In embodiments, the rail 3230 may have a 19 mm*32.5 mm as its dimensions. In embodiments, the rail 3232 may have 19 mm*65 mm as its dimensions. These structural elements

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may support the adjustable bed facility 102. The deck 3224 may be made up of wood, plastic, and the like.

In embodiments, as shown in FIG. 32C, FIG. 32D, and FIG. 32E, the truss 2402 may include lower deck 3220, stabilizing bar 3222, an 'L' bracket 3218, a screw 3214, a tee nut 3238, a shoulder screw 3240, a vertical bar 3242, a bottom rail 3234, cross bars 3258, a plastic washer 325, an 'R.' clip 3248, a motor pin 3250, and the like. In embodiments, as shown in FIG. 32E, the stabilizing bars 3222 may be connected to the bottom rail 3234 using the tee nut 3238, 'L-bracket' 3238, and the screw 3214. The stabilizing bars 3222 may be crossly connected to each other by using the shoulder screw 3234. The foot and back deck 3204 and the vertical bar 3242 may support the stabilizing bars 3222. In embodiments, the stabilizing bars 3222 may support the adjustable bed facility 102. For example, the user may put a heavy load on the adjustable bed facility 102. The stabilizing bar 3222 and the cross bars 3258 may absorb the pressure of the heavy load and may stabilize the adjustable bed facility 102. In embodiments, as explained above, the truss 2402 may help the bed to attain the position in the FIG. 32A from the FIG. 32D.

In embodiments, as shown in FIG. 32F, the mattress support section 3208 may include the mattress retained bar 3202, wood screw 3212, an end rail 3260, the screw 3210, a tee nut 3238, a foam 3228, decking 3224, the rail 3230, the rail 3232, a bottom rail 3234, and the like. It may be noted that the mattress support section may be shown to have only the above stated structural components. Those skilled in the art, however, may appreciate that the mattress support section may have lesser or more number of structural components.

In embodiments, the decking 3228 may be placed on the rail 3230. The mattress retained bar 3202 may support the mattress on the adjustable bed facility 102. The screw 3210 and the tee nut 3238 may hold the rail 3230, the rail 3232, and the end rail 3260. On loosening the screw 3210 and the tee nut 3238, the rails may be adjusted as per requirement.

In embodiments, a top view of the adjustable bed facility 102 may be provided in FIG. 32G.

In an embodiment, the adjustable bed facility 102 may have a motor mechanism connection that includes an extra tube for support. The support tube may be welded to the motor connection bracket and the steel skeleton for added support. FIGS. 34-39 depict an adjustable bed facility 102 including the support tube. Additionally, the adjustable bed facility 102 in these figures does not include wall-hugging capability or massage motors, however, it should be understood that the support tube may be included in any adjustable bed facility 102 described herein or not described herein. FIG. 33 depicts a motor connection bracket 3302. The motor connection bracket 3302 may be connected on an end to the motor and on another end to the headboard or a lever arm associated with the headboard.

FIG. 34 depicts how the head board of the adjustable bed facility connects to the motor. The motor connection bracket 3302 is shown along with the support tube 3402. The support tube 3402 connects on one end to the motor connection bracket 3302 and on another end to a vertical skeleton structure 3404. In this embodiment, only one vertical skeleton structure is shown but it should be understood that multiple vertical skeleton structures connected to the head board are possible and within the scope of this disclosure. The vertical skeleton structure may be connected to a horizontal skeleton structure 3408. The support tube 3402 provides additional support for the motor connection bracket 3302. As the motor operates and pushes the end of the motor

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connection bracket 3302 to rotate it, the headboard is also rotated to a vertical position. The support tube 3402 provides additional support to the motor connection bracket 3302 as pressure is transmitted through it by the rotation of the end connected to the motor.

FIG. 35A depicts a side view of the adjustable bed facility with the support tube. FIG. 35B depicts an underside view of the adjustable bed facility with the support tube 3402. FIG. 35C depicts a top view of the adjustable bed facility with the support tube. FIG. 36 depicts an exploded view of the adjustable bed facility connections with support tube. FIG. 37 depicts an underside view of the bed assembly with support tube 3402. FIG. 38A depicts a side view of the support tube 3402. FIG. 38B depicts a top view of the support tube 3402. FIG. 38C depicts an alternate view of the support tube 3402. FIG. 39 depicts an underside view of the bed assembly with support tube 3402.

In embodiments and referring to FIG. 40A, there may be a retaining bracket 402 on more than one side or corner of the adjustable bed facility, at various desired positions, wherein the adjustable bed is a wallhugger or a non-wallhugger. In an embodiment, there may be four retainer brackets 4002, with or without covers, each of which may be attached to the mattress platform. Referring to FIG. 40B, having retainer brackets 4002 on all four sides of the adjustable bed facility 102 may prevent the mattress 110 from shifting side by side and top to bottom such that it conforms to the adjustable bed facility 102 in various positions. In embodiments, there may be two retainer brackets 4002 disposed diagonally from one another on the mattress platform such to prevent side-to-side movement of the mattress 110. In embodiments, the brackets 4002 may be only at the head end of the mattress platform or only at the foot end of the platform. Placement of four retaining brackets as described above may be more stable and achieve greater conformity of the mattress to the adjustable bed facility 102 then using fewer retaining brackets 4002. One or more of the corner retainer bars may have covers on them so they blend in with the rest of the bed. The cover may be a fabric tubing or sleeve that slips right over the retainer bars like a sock. In embodiments, the fabric covering attaches to at least a portion of the mattress retaining bracket via one or more of a hook and loop fastener, a snap, a zipper, an adhesive, a hook and eye fastener, a sewn edge, and a staple. The fabric covering may be a sleeve that fits over the entire mattress retaining bracket. The mattress retaining bracket may be secured on one end to a first side of the mattress platform and on the other end to a second side of the mattress platform. The plurality of mattress retaining brackets may be secured on diagonally opposite corners of the mattress platform. The plurality of mattress retaining brackets may be secured on both corners of a single side of the mattress platform. The plurality of mattress retaining brackets may be secured on each corner of the mattress platform. When shipping the adjustable bed frame assembly, the plurality of mattress retaining brackets are first secured to the mattress platform in a shipment orientation and may then be re-secured in a mattress securing orientation.

In embodiments and referring to FIG. 41A, the strength and lift capacity of the drive arm or gusset 1302 may be increased. In embodiments, a piece of sheet metal or the like may be folded in a long triangle and handle style shape. Further, an end of the metal may extend from the end of the actuator to the massage motor location as shown in FIG. 41B which shows the underside of the adjustable bed facility. The gusset 1302 may attach to the wood closer to the head half of the head wood section than the foot half of the head wood

section. The attachment may be attached within the upper $\frac{1}{3}$ of head wood section, optionally to a curved frame member **4102**. The gusset **1302** attachment point may be as close to the head as the edge of the massage motor mount. By extending the gusset in such a manner, the contact point of the mechanism may be further towards the head of the bed. Such an arrangement may result in greater lift capacity and such an increase may be as much or more than 20-30% more lift capacity. Providing a contact point further towards the head of the bed may provide a better leverage point. In embodiments, the triangle and handle shape may be made of one piece of folded sheet metal or the like. In embodiments, there may be a hole or opening in the folded sheet metal, or other material, such that the material may be folded more easily.

In embodiments and referring to FIG. **42** and FIG. **40B**, fabric may be attached to the non-articulating frame to provide covering or visibility shielding of various segments of the adjustable bed facility, wherein the adjustable bed facility is a wallhugger or a non-wallhugger. For example a piece of fabric or other material, such as a resilient material or a decorative material, may be attached to the base frame of the adjustable bed facility to prevent the mechanics under the bed from being visible. Attaching fabric in such a manner may prevent items, people, animals, and the like from getting under the bed. Such covering may, therefore, reduce safety concerns. In embodiments, the fabric may be attached to the adjustable bed facility **102** in such a way as to prevent the mechanics from being visible when the head or other portion of the bed is raised, in an adjusted position or otherwise. The fabric may be attached to the frame using steel, wood and/or by other means. In embodiments, the fabric or other material may be attached in such a way that underneath the bed is not visible, and/or so that the space between the articulating frame and bottom/base frame is not visible when the bed is in a raised, lowered or other position. In embodiments, fabric may be wrapped around the back of the adjustable bed facility near the head portion. In embodiments, the fabric covering the articulating decking may cover the retainer brackets **4002** or it may include openings to accommodate the retainer brackets **4002** to be inserted through the openings or may be situated in such a way as to not cover the retainer brackets **4002**.

In an embodiment, fabric, wood, or other decorative or concealing material, may be known as a concealing assembly **4004** and visible in FIG. **40B**. In embodiments, the concealing assembly **4004** may be attached anywhere on the articulating frame, such as the skeleton, mattress platform, or both, at least at the head section such that as the head section articulates the concealing assembly **4004** is caused to articulate with the head section. Another piece of material, an inner skirt **4602**, may be located at or within the boundary of the concealing assembly **4004** but may be connected to the head section of the base frame on a bracket **4604**, **5704** such that as at least the head articulates the concealing assembly **4004** does not articulate but nonetheless remains connected to the articulating frame. Yet another foot section inner skirt may be located at or within the boundary of the concealing assembly **4004** but may be connected to the foot section of the articulating frame or the center frame such that as at least the head articulates, the concealing assembly **4004** and foot section inner skirt move with the articulating frame. Thus, one embodiment may include a concealing assembly **4004** attached to a center frame of the bed that articulates with the bed, an inner skirt **4602** attached to the head section of the base frame and within the concealing assembly **4004** boundary that conceals an area but does not articulate, and

a foot section inner skirt attached to the foot section of the articulating frame or the center frame that is also within the concealing assembly **4004** boundary and moves when the articulating frame moves. In embodiments, the concealing assembly **4004** may be attached on at least two sides anywhere on the articulating frame such that as at least when the head section articulates the concealing assembly **4004** moves along with the articulating frame. In embodiments, the bed may be a wallhugger where there is a connection between the articulating frame and base frame such that as the head of the articulating frame articulates, the articulating frame is caused to move towards the head section of the bed. The concealing assembly **4004** may be fitted with a mechanism to allow for bending such that as the articulating frame moves towards the head of the bed the concealing assembly **4004** may bend in some direction to allow the articulating frame to continue moving towards the wall.

In other embodiments, the concealing assembly **4004** may be attached anywhere on the base frame. The concealing assembly **4004** may be attached on at least two sides such that when the head section articulates, the concealing assembly **4004** does not articulate with the head section. An inner skirt may be located at or within the boundary of the concealing assembly **4004** but connected to the head portion of the base frame and may be fixed. Yet another inner skirt may be located at or within the boundary of the concealing assembly **4004** but connected to the foot portion of the base frame and may also be fixed.

In embodiments, and referring to FIG. **40B**, the decking portion of the articulating frame may be fitted with fabric that allows for bending such that as the top frame moves towards the head of the bed the fabric may bend in some direction to allow the top frame to continue moving towards the wall. In embodiments, there may be slits in the side rail and seams in the fabric where the bed articulates such that it relieves pressure on the foam and fabric, such as in FIG. **40B**, FIG. **43A** and FIG. **43C**. Gaps created between the foam rail sections may be less noticeable or covered by fabric wrapped around or otherwise fastened to the adjustable bed facility **102**. In FIG. **43A**, each section has its own fabric wrap while the bed in FIG. **43C** has all of the bed sections wrapped continuously. Such slits and seams in the side rail and fabric may prevent wrinkles from being created on the foam and fabric. In FIG. **43B**, a different design enables the entire upper frame to appear as one continuous platform for articulation.

In embodiments, front and or corner retainer brackets **402** may be covered with fabric or other material. In embodiments, the fabric or other material may wrap around the entire bracket or may only cover the steel.

In embodiments there may be slits in the side rail and seams in the fabric where the bed articulates such that it relieves pressure on the foam and fabric, such as in FIG. **43A** and FIG. **43C**. Gaps created between the foam rail sections may be less noticeable or covered by fabric wrapped around or otherwise fastened to the adjustable bed facility **102**. In FIG. **43A**, each section has its own fabric wrap while the bed in FIG. **43C** has all of the bed sections wrapped continuously. Such slits and seams in the side rail and fabric may prevent wrinkles from being created on the foam and fabric. In FIG. **43B**, a different design enables the entire upper frame to appear as one continuous platform for articulation, which may be known as a deck-on-deck embodiment. In this embodiment, the base frame is concealed by a material that is attached either to the upper frame or the base frame. For example, the material may be wood panels attached the bed

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assembly in such a way that they are disposed just beneath the upper frame, thus providing the deck-on-deck appearance.

In embodiments, front and or corner retainer brackets **4002** may be covered with fabric or other material.

In embodiments and referring to FIG. **44** and FIG. **45**, the methods and systems disclosed herein may be implemented as an adjustable bed frame where the frame is a wallhugger with a rail concealing a base frame and where the rail moves rearwardly with the center frame of the bed. In embodiments, the wallhugger frame includes a center frame **4402** that is movably affixed to a stationary base frame **4404**. The center frame **4402** comprises two substantially parallel side frame members **4502** connected by both a forward connector **4506** frame member and a rear connector frame member **4504** (shown as a dashed line). The shape of the center frame **4402** may be altered in order to best accommodate bed design, such as, but not limited to, size and shape, or the materials used in the construction of the frame. Larger frames may require additional connecting frame members in order to support the load from a larger mattress. Likewise, depending on the materials the frame is made from, additional connecting frame members may be required for stability.

The stationary base frame **4404** may also include two substantially parallel side base frame members **4508** in order for the center frame to move effectively along the base frame. Those skilled in the art may recognize that other shapes of a base frame are possible, but may require additional mechanical components in order to accomplish the movement of the center frame **4402** along the base frame **4404**. The center frame may be movably affixed to the base frame using one of many methods known to the art, including using assemblies disclosed herein, such as, but not limited to, connecting the center frame **4402** to the base frame **4404** using an assembly with concave wheels rolling on a stationary base frame comprising tubular members. In embodiments, multiple points of the center frame **4402** may be movably affixed to the base frame **4404**. Other methods may exist in the art to movably affix the center frame **4402** to the base frame **4404** and may be implemented when desirable, such as, but not limited to, for aesthetic purposes, economic purposes, or to save space.

In embodiments, the center frame **4402** may be attached pivotally to a head frame **4408**. The head frame **4408** may comprise two substantially parallel side frame members **4510** and is connected by at least one connecting frame members **4512**. Additional connecting frame members may also be used if desirable. Placement of the connecting frame members **4512** between the two side frame members may vary depending on a number of factors, such as, but not limited to, strength of the materials or the aesthetics of the assembly. The lower ends of the head frame's parallel side frame members may be pivotally attached to the forward connector frame member **4506** of the center frame **4402**. This pivotal attachment **4514** may use any one of the mechanical pivoting assemblies known to the art. In embodiments, the head frame connecting frame **4512** or connecting frames may have a downward facing extension frame member attached. The head frame connecting frame **4512** or connecting frames may also have more than one downwardly facing extension frame member **4410** if desired. In embodiments, the downwardly facing extension **4410** frame member may serve multiple purposes. A stabilizer arm **4412** may serve as a supporting frame member for the load which the assembly bears when the assembly is

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being used. The stabilizer arm **4412** may connect on one end to the mattress platform **4420** and on the other end to the base frame **4404**.

The extension frame **4410** may also serve as a connecting platform for an actuator which may be deployed in the assembly in order to raise and lower the head frame and or the foot frame. One end of the actuator may be pivotally connected to the head frame's extension frame member **4410** while the opposing end of the actuator is connected to the base frame **4404**. The actuator may serve to pivot the head frame **4408** upward. Multiple actuators may be deployed if desirable, such as, but not limited, embodiments comprising more than one head frame extension frame member.

In embodiments, the assembly may comprise a mattress platform **4420** affixed to a top side of the articulating frame. The mattress platform **4420** may serve as a supporting assembly for a mattress placed on top of the assembly. The mattress platform **4420** may be assembled using any material or method known to the art.

In embodiments, the assembly may comprise a concealing assembly **4414**, which is attached to the center frame **4402**. In FIG. **45**, the concealing assembly **4524** is shown attached to the wheels **4406** of the center frame **4502** through side rail brackets **4528**. However, the side rail brackets **4528** may also be directly connected to the center frame **4502**. The concealing assembly may be situated below the mattress platform **4420**. The concealing **4414** assembly may act to conceal the base frame as the center frame **4402** moves along the base frame **4404**. In embodiments, the concealing assembly **4414** may extend outward from the center frame **4402** and be placed over the base frame **4404**. The concealing assembly **4414** may be manufactured in any one of many methods that may be desirable.

In a non-limiting example and referring to FIG. **46** and FIG. **47**, the concealing assembly **4414** may simply be an extension from the center frame which protrudes out past the base frame **4404**. In FIG. **47**, the view is a head-on view down the long axis of the center frame. A fabric or other concealing material on the concealing assembly may conceal the base frame **4404**. The use, manufacture, and design of the concealing assembly are not limited to these examples or purposes, as other methods of concealing the base assembly may be desirable in various circumstances.

In embodiments, the actuator connected to the head frame **4408** may pivot the head frame **4408** upward. As the actuator pivots the head frame **4408**, the center frame **4402** and concealing assembly **4414** may move toward the head end **4516** of the adjustable bed frame along the stationary base frame **4404**. The embodiments may be implemented as a more aesthetically pleasing method of deploying a wallhugger bed assembly. The embodiments may also result in a safer implementation of a wallhugger bed assembly, as the movement of the center frame **4402** and concealing assembly **4414** along with the actuation of the head frame **4408** may reduce or eliminate the space **4808** between at the bottom end of the bed between the concealing assembly and the mattress platform. FIG. **48** shows a comparison of two beds where the one with no space **4808** is a bed with a concealing assembly that moves along with the center frame whereas the bed with space **4802** does not have a concealing assembly that moves along with the center frame. Too much distance **4802** between the bottom end of the center frame **4402** and the base frame **4404** may not be aesthetically pleasing and could cause frustration for a user when arranging their adjustable bed, such as items dropped into the space, bedding materials becoming entangled in the

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mechanical components of the assembly, or even limbs getting caught, to name a few. Movement of the center frame **4402** along with the concealing assembly **4414** along the stationary base frame **4404** may decrease those risks, resulting in a more enjoyable and safer experience for a user.

In embodiments, the center frame may be constructed using any materials known to the art that may be desirable. Materials such as wood or steel, but not limited to these materials, may be used in order to construct a center frame, a head frame, mattress platform, or any of the other components which comprise the assembly. Combinations of materials may also be used when desirable. In a non-limiting example, the center frame may be constructed out of steel, but the mattress platform on which the mattress is placed may be constructed out of wood. Manufacturers as well as those skilled in the art may recognize that various combinations of materials can serve as distinguishing factors when constructing different product lines. Assemblies made from higher quality materials or with mechanically sturdier construction (i.e. with more supporting frame connectors) may be priced higher than others.

In embodiments, the concealing assembly **4414** may be omitted in either wallhugger or non-wallhugger type bed assemblies. Thus, in embodiments of wallhugger bed assemblies, though the center frame is movably affixed to the stationary base frame and moves toward the head end of the bed frame assembly with respect to the stationary base frame, the movement of the center frame may be visible to users. Likewise, in embodiments of non-wallhugger bed assemblies, there may nonetheless still be a concealing assembly present despite the bed's inability to rearwardly move during articulation. In these embodiments, there may still exist a center frame affixed to a stationary base frame with a pivotally connected head frame which may move up and down; however, these embodiments may lack the mechanics to move the center frame toward the head of the bed frame assembly as the actuator moves the head frame up and down. Those skilled in the art will recognize that both wallhugger and non-wallhugger beds may thus be implemented in the same bed frame, just with certain functions disabled or enabled.

The benefits to embodiments where wallhugger functionality can be added or omitted in the same structural assembly are readily apparent. Manufacturers may be able to produce large amounts of similar bed assemblies without having to first predict the number of wallhugger or non-wallhuggers that consumers may order. Consumers who choose to enable wallhugger functionality can simply indicate their decision and a manufacturer can very easily install wallhugger enabled machinery into the existing structural bed assembly. Likewise, manufacturers and merchants may be able to offer various quality "tiers" of beds to consumers. In a non-limiting example, an adjustable bed merchant may offer its lowest quality lines of articulating beds lacking the movement mechanism attached to the center frame to enable the wallhugging functionality—this embodiment may or may not also include a concealing assembly. The merchant may then offer the exact same bed at a higher price only with a concealing assembly, which may be easily added on or even purchased separately by the consumer. Furthermore, a merchant may then offer its "premier" line of adjustable beds, with both wallhugger functionality and an optional concealing assembly. In versions of this premier, wallhugger-style bed, the design may be either deck-on-deck as shown in FIG. **43B**, or non-deck-on-deck, as shown in FIG. **43A** and FIG. **43C**. Thus, manufacturers and merchants of these beds gain access to valuable marketing strategies, as consumers gain

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the opportunity to personalize their beds, or at least choose from a variety of different bed options. Though the ability to create different types of beds exists independently of the methods and systems disclosed herein, nonetheless, the methods and systems disclosed herein allow manufacturers to cut down production and design costs significantly by providing an adjustable bed frame assembly which can easily be adapted to fit the needs of consumers.

In embodiments, the methods and systems described herein may be deployed as a kit for constructing an adjustable bed frame assembly, also known as a "knock-down" kit. In the current state of the art, manufacturers of bed frames may wish to obtain their materials or assembly parts from overseas. Due to the cost of shipping and limited space, it may be desirable for manufacturers to be able to receive all of the necessary parts for construction of an adjustable bed frame prior to their assembly of the adjustable bed frame, with as much of the adjustable bed preassembled, while conserving space. In embodiments, the knock-down kit may include several parts and materials for construction of an adjustable bed assembly. In embodiments, the kit may be customized in accordance with the "tiers" of bed described above. Having common components among the various tiers of beds may facilitate assembling kits of beds. For example, all articulating wallhugger kits may include the same base frame, however, the articulating frame may be different in a kit for a deck-on-deck bed versus a non-deck-on-deck bed.

In embodiments, certain connections in the bed do not have to be welded. These may include: motor mechanism (where the motor mounts to the head and to the foot and pushes on bed), steel pieces that drop down from the center frame and connect to the wheels, foot support bar (attaches to foot wood and center steel frame), all headboard brackets, crossbar and substantially tubular steel, and other connections not specifically called out here.

As shown in FIG. **49**, in embodiments, the kit may comprise a center frame **4902**. The center frame **4902** may comprise two substantially parallel side center frame members **4904** connected by two connector frame members, a forward center connector frame **4906** member a rear center connector **4908** frame member. The kit may additionally comprise a head frame **4910**. The head frame **4910** may include two substantially parallel side head frame members **4912** connected by at least one head frame connector member **4914**. The lower ends of the head frame's parallel side frame members may be pivotally attached to the forward connector frame member of the center frame. The pivotal attachment **4916** may be implemented using bolts or any other method known to the art.

Additionally, the kit may comprise a mattress platform **4918** in order to provide support for a mattress. The mattress platform may be affixed to the center **4902**, head frame **4910**, and/or foot frame **4924** using any of the methods known to the art, such as, but not limited to, gluing, welding, bolting, or affixing a brace and using bolts to connect the brace to the mattress platform **4918**. The mattress platform **4918** may be constructed out of wood, but is not limited to this material, and may be constructed using any material known to the art that may be desirable. As a non-limiting example, a wood mattress platform may be cheap, while a plastic mattress platform may be lighter for shipping purposes. Furthermore, in embodiments, the mattress platform **4918** may be divided into multiple sections, such as, but not limited to, dividing the mattress platform into a head, torso, leg, and foot section in order to accommodate consumer desires or bed designs. In embodiments, the mattress platform may have a fabric covering either on the top or the bottom, which may be

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implemented for a variety of reasons, such as, but not limited to, aesthetic purposes or protection. Likewise, the mattress platform may have cushioning on the top of the mattress in addition to a fabric layer. The cushioning may be constructed from foam, or any other material known to the art that may be desirable for a manufacturer or consumer. In embodiments, the mattress platform **4918** may have additional cushioning along the sides **4922** of the mattress platform **4918**, in order to further protect the mattress platform **4918** or any other reason for added cushioning. This cushioning may be constructed from the same material as the cushioning used for the top of the mattress platform **4918**, or a different material. The kit may also comprise a stabilizing bar **4920**, which may be connected to the mattress platform **4918** using bolts and which may stabilize the head frame when in an articulate position.

In embodiments, the kit may comprise a foot frame **4924**, a close up of which is demonstrated in a non-limiting embodiment in FIG. **50A** and FIG. **50B**. The foot frame **4924** may comprise two substantially parallel side foot frame members **5002** connected by at least one foot frame connector frame **5004**. Also depicted is a thigh frame **5010**. In embodiments, the foot frame **4924** and thigh frame **5010** may be affixed to the mattress platform **4918**, using a variety of methods, such as, but not limited to, welding, glue, or bolts. In embodiments the foot frame **4924** and thigh frame **5010** may be substantially tubular and shaped to resemble a “U” or “C”. In embodiments, the foot frame **4924** or thigh frame **5010** may be affixed to the mattress platform **4918** via a bracket **5006**, hinge **5012**, or the like. In embodiments, the foot frame **4924** or thigh frame may be affixed to the mattress platform **4918** in such a manner so that the foot frame may move pivotally. In embodiments, the foot frame **4924** may be secured during transportation of the frame using a fastener **5008**, such as, but not limited to, a piece of fabric stapled to the mattress platform **4918**. In embodiments, these fasteners **5008** may secure the foot frame **4924** so that there is no movement of the foot frame **4924** during transportation, preventing damage to the frame and also preventing possible injury arising from handling the assembly.

As seen in FIG. **51**, in embodiments, the kit may comprise at least one extension frame members **5102**. These extension frame members **5102** may be coupled with actuators **5104** in order to extend certain frames of the adjustable bed assembly upward or downward. In embodiments, the kit may comprise at least one actuator **5104**. Actuators **5104** may be attached to extension frame members **5102** using, but not limited to, bolts or welding and may be pivotally attached for increased range of motion. In embodiments, multiple extension frame members or actuators may be used. In a non-limiting example, adjustable bed assemblies for which the head frame is the only frame to move upwardly or downwardly may only have a single extension frame members **5102** connected to the head frame **4910**. In this same example, a single actuator **5104**, may have one end pivotally affixed to the extension frame member **5102** and another end affixed to the mattress platform **4918** using methods such as, but not limited to, welding or bolts.

The kit may comprise a plurality of roller brackets **5106**, which may be used to support the wheel designed to move the frame of the adjustable bed assembly horizontally. As demonstrated in FIG. **52**, in embodiments, the kit may comprise a plurality of concave wheels **5202**, or other movement mechanisms such as slides, which are affixed to the roller bracket **5106**. It should be understood that this kit may also be constructed with a base frame that includes a

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C-channel and a center frame that includes wheels that fit into or along the C-channel, as described herein. These concave wheels **5202** may serve to move the frame assembly along a track, providing freedom of movement for wallhugger functionality. The wheels **5202** may be affixed to the roller bracket **5106** using removable bolts or other similar methods. In embodiments, the kit may comprise concave wheels **5202** included separately from the bolts that attach the concave wheels **5202** to the roller brackets **5106**. In such embodiments, a wheel connecting member **5204** may be inserted through the center of the concave wheel **5202** and affixed to the roller bracket **5106**. The roller bracket **5106** may be affixed to the center frame **4902**, using one of many methods, including, but not limited to, bolts.

In embodiments, the kit may comprise a plurality of side rail brackets **5108**. These brackets **5108** may be manufactured in the shape of an “L.” The side rail brackets **5108** may be affixed to the center frame **4902** using a variety of methods, including, but not limited to, welding or bolts. As shown in FIG. **53** the side rail brackets **5108** may also be affixed to a concealing assembly including a concealing side rail **5302**. The concealing side rail **5302** may serve to conceal the components of the adjustable bed assembly during frame movements, such as, but not limited to, when the bed is used for wallhugger capabilities. The concealing side rail **5302** may be affixed to the side rail brackets **5108** using methods such as, but not limited to, bolts or welding. The concealing side rail **5302** may comprise two substantially parallel concealing side members **5304** as well as a concealing connecting member **5306**. The members of the concealing side rail **5302** may be covered with fabric. The members of the concealing side rail **5302** may also be covered with cushioning. The concealing side rail **5302** may be shipped fully constructed, with the parallel concealing side members **5304** and connector member **5306** already affixed to one another. The concealing side rail **5302** may be shipped with fabric and cushioning already assembled. The concealing side rail **5302** may also be shipped as each individual component, requiring additional assembly from either the consumer or an intermediary.

As shown in FIG. **54**, in embodiments, the kit may include a base frame **5402**. The base frame may include two substantially parallel side base frame members **5404**, a forward base frame connector member **5406**, and a rear base frame connector member **5408**. The two substantially parallel side base frame members **5404** may be substantially tubular in shape. The side base frame members **5404** may be affixed to the base frame connector members **5406** **5408** by any of the methods known to the art, such as, but not limited to, welding or bolts. The base frame **5402** may be preassembled or packaged as separate components depending on preference. As shown in FIG. **52**, in embodiments the base frame **5402** may be affixed to the adjustable bed assembly by resting the substantially concave wheel **5202** affixed to a roller bracket **5106** on a side base frame member, using the base frame **5402** as a track for the wheels to travel on in order to implement the wallhugger feature. A roller frame securing mechanism **5206** may be affixed to the roller bracket **5106** so that the side base frame **5404** member rests in between the roller frame securing mechanism **5206** and the concave wheel **5202**. In embodiments, the roller frame securing mechanism **5206** may function to prevent the base frame **5402** and the center frame **4902** from separating. In embodiments, the foot frame may be affixed to the wheel connecting member **5208**, allowing the foot frame to move concurrently with the frame without the use of an additional actuator.

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In embodiments, the stabilizing bar **4920** affixed to the mattress platform **4918** may also be affixed to the forward base frame member **5502**. In embodiments, at least one massage motor **5504** may be affixed to the mattress platform.

As shown in FIG. **56**, in embodiments of a non-wallhugger bed, the kit may comprise a plurality of leg members **5602**, to elevate the adjustable bed assembly from the ground, wherein the leg members **5602** may be affixed to the substantially parallel side center frame members **5608**. The leg members **5602** may be connected with at least one leg connector **5604** frame member, so as to provide more support. The leg connector frame member **5604** may be placed anywhere in between leg members **5602**. The leg connector frame member **5604** may be placed in a manner so that the leg connector frame member **5604** is perpendicular to the leg members **5602**; however, the placement of the leg connector **5604** frame members is not limited to this embodiment. In embodiments, the kit may include a plurality of leg concealers **5606**. These leg concealers **5606** may be cylindrical. The leg concealers **5606** may be constructed from, but not limited to, metal or plastic. The leg concealers **5606** may be affixed to the leg members **5602** by any method known to the art, including, but not limited to, snapping on, welding, or being bolted on.

In embodiments, a modular leg construction using threaded members is depicted in FIG. **58A**, FIG. **58B**, and FIG. **58C**. FIG. **58C** depicts a threaded leg member of one size, FIG. **58B** depicts a threaded leg member of another size, and FIG. **58A** depicts a combination leg foamed from threading the threaded leg members depicted in FIGS. **58B** and **58C** together. For example, one threaded member may be three inches, as in FIG. **58C** and another threaded member may be five inches, as in FIG. **58B**. These two threaded members may be used individually to provide legs for the bed of a certain height. However, the legs may also be threaded together to provide a longer leg, such as the eight inch leg that is shown in FIG. **58A**.

In embodiments, the kit may comprise a plurality of inner skirt supports **5704**. These supports **5704** may be affixed to the forward base frame connector **5406**. These supports **5704** may also be affixed to the rear base frame **5408** connector as well. The inner skirt **5704** supports may also be affixed to the roller bracket, center frame, side rail bracket, or any other component of the adjustable bed assembly. The inner skirt **5704** supports may be affixed using welding, bolts, or any other method known to the art.

In embodiments, the center frame, head frame, stabilizing bar, and foot frame may be affixed to the mattress platform in a preassembly, prior to construction of the adjustable bed frame assembly. Other components, such as, but not limited to, the extension frame members, the base frame, concave wheels, roller bracket, side rail bracket, and actuators, may be shipped in the same package as the preassembly, but may be deconstructed into individual components. In embodiments, a merchant or user receiving the kit sent by the manufacturer may construct the adjustable bed assembly by connecting the deconstructed individual components to the preassembly. In embodiments, construction materials such as bolts required to connect components to the preassembly may be included in the kit. In embodiments, the adjustable frame assembly components may be affixed to one another using a variety of methods, such as, but not limited to bolts, welding, gluing, or using brackets.

In embodiments, the systems and methods disclosed herein may comprise a method of constructing an adjustable bed assembly from a construction kit. The method may comprise adding foam or fabric in order to protect the

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assembly or provide aesthetic value. The foam and fabric may be affixed using stapling, gluing, or any other method known to the art. The method of constructing the kit may comprise affixing an extension frame member to the head frame. In embodiments, the method may comprise affixing an actuator to the mattress platform as well as affixing the actuator to an extension frame member. In embodiments, the method may comprise affixing an extension frame member to the rear center connector frame member. The method may comprise affixing an actuator to this extension frame member. The method may comprise affixing a roller bracket and a side rail bracket to a side center frame member. Additionally, the method may comprise affixing a substantially concave wheel to the roller bracket in order to provide movement for wallhugger functionality. In embodiments, the method may comprise affixing a foot extension frame member to the mattress platform. The method may comprise removal of fabric which may have been placed to prevent the foot frame from moving during shipping. The method may comprise constructing the base frame and setting the base side rails on the substantially concave wheels, which have been affixed to the roller bracket, so that the substantially concave wheels may roll along the base side frame members like a track. In embodiments, the method may comprise affixing a roller frame securing mechanism to the roller frame so that the base frame does not separate from the substantially concave wheels. The method may comprise affixing the foot frame may be affixed to the wheel connecting member by affixing a foot side frame member to a wheel connecting member. The method may further comprise affixing a plurality of inner skirt supports along the side center frame members. The method may further comprise affixing a plurality of inner skirt supports to the forward base frame connector member. In embodiments, the method may comprise constructing a concealing side rail. The method in which the concealing side rail is constructed may comprise affixing two substantially parallel side concealing frame members to a concealing connector frame member. In embodiments, the method of constructing the adjustable bed assembly may comprise affixing the concealing side rail to the plurality of side rail brackets. The method may comprise affixing the stabilizer bar, which is affixed on one end to the mattress platform, to the forward connector base frame member. The method may comprise affixing a massage motor to the mattress platform. The method may comprise affixing leg members to the side center frame members. The method may comprise affixing a leg connector frame member to the leg members. The method may comprise affixing leg concealers to the leg members.

In other embodiments and referring to FIG. **42**, fabric or other resilient material, such as panels, rails or any other concealing assembly, may be attached to the center frame or the decking associated with the center frame or both of a wallhugger bed. As the top frame of the adjustable bed articulates causing the head section to raise and the center frame to translate towards the head end of the bed, the concealing assembly is caused to also move towards the head end of the bed along with the center frame.

The methods and systems described herein may be deployed in part or in whole through a machine that executes computer software, program codes, and/or instructions on a processor. The processor may be part of a server, client, network infrastructure, mobile computing platform, stationary computing platform, or other computing platform. A processor may be any kind of computational or processing device capable of executing program instructions, codes, binary instructions and the like. The processor may be or

include a signal processor, digital processor, embedded processor, microprocessor or any variant such as a co-processor (math co-processor, graphic co-processor, communication co-processor and the like) and the like that may directly or indirectly facilitate execution of program code or program instructions stored thereon. In addition, the processor may enable execution of multiple programs, threads, and codes. The threads may be executed simultaneously to enhance the performance of the processor and to facilitate simultaneous operations of the application. By way of implementation, methods, program codes, program instructions and the like described herein may be implemented in one or more thread. The thread may spawn other threads that may have assigned priorities associated with them; the processor may execute these threads based on priority or any other order based on instructions provided in the program code. The processor may include memory that stores methods, codes, instructions and programs as described herein and elsewhere. The processor may access a storage medium through an interface that may store methods, codes, and instructions as described herein and elsewhere. The storage medium associated with the processor for storing methods, programs, codes, program instructions or other type of instructions capable of being executed by the computing or processing device may include but may not be limited to one or more of a CD-ROM, DVD, memory, hard disk, flash drive, RAM, ROM, cache and the like.

A processor may include one or more cores that may enhance speed and performance of a multiprocessor. In embodiments, the process may be a dual core processor, quad core processors, other chip-level multiprocessor and the like that combine two or more independent cores (called a die).

The methods and systems described herein may be deployed in part or in whole through a machine that executes computer software on a server, client, firewall, gateway, hub, router, or other such computer and/or networking hardware. The software program may be associated with a server that may include a file server, print server, domain server, internet server, intranet server and other variants such as secondary server, host server, distributed server and the like. The server may include one or more of memories, processors, computer readable media, storage media, ports (physical and virtual), communication devices, and interfaces capable of accessing other servers, clients, machines, and devices through a wired or a wireless medium, and the like. The methods, programs or codes as described herein and elsewhere may be executed by the server. In addition, other devices required for execution of methods as described in this application may be considered as a part of the infrastructure associated with the server.

The server may provide an interface to other devices including, without limitation, clients, other servers, printers, database servers, print servers, file servers, communication servers, distributed servers and the like. Additionally, this coupling and/or connection may facilitate remote execution of program across the network. The networking of some or all of these devices may facilitate parallel processing of a program or method at one or more location without deviating from the scope of the invention. In addition, any of the devices attached to the server through an interface may include at least one storage medium capable of storing methods, programs, code and/or instructions. A central repository may provide program instructions to be executed on different devices. In this implementation, the remote repository may act as a storage medium for program code, instructions, and programs.

The software program may be associated with a client that may include a file client, print client, domain client, internet client, intranet client and other variants such as secondary client, host client, distributed client and the like. The client may include one or more of memories, processors, computer readable media, storage media, ports (physical and virtual), communication devices, and interfaces capable of accessing other clients, servers, machines, and devices through a wired or a wireless medium, and the like. The methods, programs or codes as described herein and elsewhere may be executed by the client. In addition, other devices required for execution of methods as described in this application may be considered as a part of the infrastructure associated with the client.

The client may provide an interface to other devices including, without limitation, servers, other clients, printers, database servers, print servers, file servers, communication servers, distributed servers and the like. Additionally, this coupling and/or connection may facilitate remote execution of program across the network. The networking of some or all of these devices may facilitate parallel processing of a program or method at one or more location without deviating from the scope of the invention. In addition, any of the devices attached to the client through an interface may include at least one storage medium capable of storing methods, programs, applications, code and/or instructions. A central repository may provide program instructions to be executed on different devices. In this implementation, the remote repository may act as a storage medium for program code, instructions, and programs.

The methods and systems described herein may be deployed in part or in whole through network infrastructures. The network infrastructure may include elements such as computing devices, servers, routers, hubs, firewalls, clients, personal computers, communication devices, routing devices and other active and passive devices, modules and/or components as known in the art. The computing and/or non-computing device(s) associated with the network infrastructure may include, apart from other components, a storage medium such as flash memory, buffer, stack, RAM, ROM and the like. The processes, methods, program codes, instructions described herein and elsewhere may be executed by one or more of the network infrastructural elements.

The methods, program codes, and instructions described herein and elsewhere may be implemented on a cellular network having multiple cells. The cellular network may either be frequency division multiple access (FDMA) network or code division multiple access (CDMA) network. The cellular network may include mobile devices, cell sites, base stations, repeaters, antennas, towers, and the like. The cell network may be a GSM, GPRS, 3G, EVDO, mesh, or other networks types.

The methods, programs codes, and instructions described herein and elsewhere may be implemented on or through mobile devices. The mobile devices may include navigation devices, cell phones, mobile phones, mobile personal digital assistants, laptops, palmtops, netbooks, pagers, electronic books readers, music players and the like. These devices may include, apart from other components, a storage medium such as a flash memory, buffer, RAM, ROM and one or more computing devices. The computing devices associated with mobile devices may be enabled to execute program codes, methods, and instructions stored thereon. Alternatively, the mobile devices may be configured to execute instructions in collaboration with other devices. The mobile devices may communicate with base stations inter-

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faced with servers and configured to execute program codes. The mobile devices may communicate on a peer to peer network, mesh network, or other communications network. The program code may be stored on the storage medium associated with the server and executed by a computing device embedded within the server. The base station may include a computing device and a storage medium. The storage device may store program codes and instructions executed by the computing devices associated with the base station.

The computer software, program codes, and/or instructions may be stored and/or accessed on machine readable media that may include: computer components, devices, and recording media that retain digital data used for computing for some interval of time; semiconductor storage known as random access memory (RAM); mass storage typically for more permanent storage, such as optical discs, forms of magnetic storage like hard disks, tapes, drums, cards and other types; processor registers, cache memory, volatile memory, non-volatile memory; optical storage such as CD, DVD; removable media such as flash memory (e.g. USB sticks or keys), floppy disks, magnetic tape, paper tape, punch cards, standalone RAM disks, Zip drives, removable mass storage, off-line, and the like; other computer memory such as dynamic memory, static memory, read/write storage, mutable storage, read only, random access, sequential access, location addressable, file addressable, content addressable, network attached storage, storage area network, bar codes, magnetic ink, and the like.

The methods and systems described herein may transform physical and/or intangible items from one state to another. The methods and systems described herein may also transform data representing physical and/or intangible items from one state to another.

The elements described and depicted herein, including in flow charts and block diagrams throughout the figures, imply logical boundaries between the elements. However, according to software or hardware engineering practices, the depicted elements and the functions thereof may be implemented on machines through computer executable media having a processor capable of executing program instructions stored thereon as a monolithic software structure, as standalone software modules, or as modules that employ external routines, code, services, and so forth, or any combination of these, and all such implementations may be within the scope of the present disclosure. Examples of such machines may include, but may not be limited to, personal digital assistants, laptops, personal computers, mobile phones, other handheld computing devices, medical equipment, wired or wireless communication devices, transducers, chips, calculators, satellites, tablet PCs, electronic books, gadgets, electronic devices, devices having artificial intelligence, computing devices, networking equipment, servers, routers and the like. Furthermore, the elements depicted in the flow chart and block diagrams or any other logical component may be implemented on a machine capable of executing program instructions. Thus, while the foregoing drawings and descriptions set forth functional aspects of the disclosed systems, no particular arrangement of software for implementing these functional aspects should be inferred from these descriptions unless explicitly stated or otherwise clear from the context. Similarly, it will be appreciated that the various steps identified and described above may be varied, and that the order of steps may be adapted to particular applications of the techniques disclosed herein. All such variations and modifications are intended to fall within the scope of this disclosure. As such, the depic-

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tion and/or description of an order for various steps should not be understood to require a particular order of execution for those steps, unless required by a particular application, or explicitly stated or otherwise clear from the context.

The methods and/or processes described above, and steps thereof, may be realized in hardware, software or any combination of hardware and software suitable for a particular application. The hardware may include a general purpose computer and/or dedicated computing device or specific computing device or particular aspect or component of a specific computing device. The processes may be realized in one or more microprocessors, microcontrollers, embedded microcontrollers, programmable digital signal processors or other programmable device, along with internal and/or external memory. The processes may also, or instead, be embodied in an application specific integrated circuit, a programmable gate array, programmable array logic, or any other device or combination of devices that may be configured to process electronic signals. It will further be appreciated that one or more of the processes may be realized as a computer executable code capable of being executed on a machine readable medium.

The computer executable code may be created using a structured programming language such as C, an object oriented programming language such as C++, or any other high-level or low-level programming language (including assembly languages, hardware description languages, and database programming languages and technologies) that may be stored, compiled or interpreted to run on one of the above devices, as well as heterogeneous combinations of processors, processor architectures, or combinations of different hardware and software, or any other machine capable of executing program instructions.

Thus, in one aspect, each method described above and combinations thereof may be embodied in computer executable code that, when executing on one or more computing devices, performs the steps thereof. In another aspect, the methods may be embodied in systems that perform the steps thereof, and may be distributed across devices in a number of ways, or all of the functionality may be integrated into a dedicated, standalone device or other hardware. In another aspect, the means for performing the steps associated with the processes described above may include any of the hardware and/or software described above. All such permutations and combinations are intended to fall within the scope of the present disclosure.

While the invention has been disclosed in connection with the preferred embodiments shown and described in detail, various modifications and improvements thereon will become readily apparent to those skilled in the art. Accordingly, the spirit and scope of the present invention is not to be limited by the foregoing examples, but is to be understood in the broadest sense allowable by law.

All documents referenced herein are hereby incorporated by reference.

What is claimed is:

1. A support system, comprising:

a support frame; and

at least one modular leg assembly mounted to and supporting the support frame, the leg assembly comprising;

a first leg member having a body portion with an outer surface, a top end and an opposite bottom end, the top end having a top surface and the bottom end having a substantially horizontal bottom surface, the outer surface extending beyond the top surface and having a top edge such that the top surface is

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- recessed relative to the top edge, body portion having a first top-to-bottom length defined between the top edge and bottom surface; and
- a second leg member having a body portion with an outer surface, a top end and an opposite bottom end, the top end having a top surface and the bottom end having a substantially horizontal bottom surface, the outer surface extending beyond the top surface and having a top edge such that the top surface is recessed relative to the top edge, the body portion having a second top-to-bottom length defined between the top edge and bottom surface, the second top-to-bottom length being greater than the first top-to-bottom length;
- wherein the first and second leg members are connected individually or in combination to the support frame such that at least three leg heights are selectably provided; and
- wherein when the first and second leg members are connected in combination, the top edge of the outer surface of one of the leg members is disposed against and under the bottom surface of the other of the leg members such that the outer surfaces are continuous with one another.
2. The support system of claim 1, wherein the first and second leg members each have a connecting element extending from the top surface thereof for connecting the leg member to another leg member or to the support frame.
3. The support system of claim 2, wherein the connecting elements are threaded elements.
4. The support system of claim 1, wherein the support frame includes a base frame and an articulating frame supported by the base frame, the leg members being connectable to the base frame.
5. The support system of claim 1, wherein the support frame is a mattress support frame.
6. The support system of claim 1, wherein the at least one modular leg assembly comprises a plurality of modular leg assemblies.
7. The support system of claim 1, wherein:
- the body portions of each of the leg members have a circular cross section; and
- the circular cross sectional size of one of the leg members at the top surface is equal to the circular cross sectional size of the other of the leg members at the bottom surface.
8. The support system of claim 7, wherein the body portions are cylindrical.
9. A bed foundation, comprising:
- a mattress support frame having a base frame and an articulating frame supported on the base frame; and
- a plurality of modular leg assemblies, each leg assembly comprising:
- a first threaded member having a body portion with an outer surface, a top end, an opposite bottom end and a threaded element extending from the top end, the top end having a top surface and the bottom end having a substantially horizontal bottom surface, the outer surface extending beyond the top surface and having a top edge such that the top surface is recessed relative to the top edge, the body portion having a first top-to-bottom length defined between the top edge and bottom surface; and
- a second threaded member having a body portion with an outer surface, a top end, an opposite bottom end and a threaded element extending from the top end, the top end having a top surface and the bottom end

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- having a substantially horizontal bottom surface, the outer surface extending beyond the top surface and having a top edge such that the top surface is recessed relative to the top edge, the body portion having a second top-to-bottom length defined between the top edge and bottom surface, the second top-to-bottom length being greater than the first top-to-bottom length;
- wherein a plurality of the first threaded members are each connected to the base frame to provide a first leg length for the bed foundation, a plurality of the second threaded members are each connected to the base frame to provide a second leg length for the bed foundation, and a plurality of threaded together first and second threaded members are connected to the base frame to provide a third leg length greater than the first or second leg length; and
- wherein the threaded together first and second threaded members have the top edge of one of the threaded members disposed against and under the bottom surface of the other of the threaded members such that the outer surfaces are continuous with one another.
10. The bed foundation of claim 9, wherein:
- the body portions of each of the threaded members have a circular cross section; and
- the circular cross sectional size of one of the threaded members at the top surface is equal to the circular cross sectional size of another of the threaded members at the bottom surface.
11. The bed foundation of claim 10, wherein the body portions are cylindrical.
12. A modular leg kit for a bed foundation having a base frame, the modular leg kit comprising:
- a plurality of first leg members each having a body portion with an outer surface, a top end and an opposite bottom end, the top end having a top surface and the bottom end having a substantially horizontal bottom surface, the outer surface extending beyond the top surface and having a top edge such that the top surface is recessed relative to the top edge, the body portion having a first top-to-bottom length defined between the top surface and bottom surface; and
- a plurality of second leg members each having a body portion with an outer surface, a top end and an opposite bottom end, the top end having a top surface and the bottom end having a substantially horizontal bottom surface, the outer surface extending beyond the top surface and having a top edge such that the top surface is recessed relative to the top edge, the body portion having a second top-to-bottom length defined between the top surface and bottom surface, the second top-to-bottom length being greater than the first top-to-bottom length;
- wherein a plurality of the first leg members are each connected to the base frame to provide a first leg length for the bed foundation, a plurality of the second leg members are each connected to the base frame to provide a second leg length for the bed foundation, and a plurality of connected together first and second leg members are connected to the base frame to provide a third leg length greater than the first or second leg length; and
- wherein the connected together first and second leg members have the top edge of the outer surface of one of the leg members disposed against and under the bottom

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surface of the other of the leg members such that the outer surfaces are continuous with one another.

13. The modular leg kit of claim **12**, wherein each of the first and second leg members have a connecting element extending therefrom for connecting the leg member to
5 another leg member or to the bed foundation.

14. The modular leg kit of claim **13**, wherein the connecting elements are threaded elements.

15. The modular leg kit of claim **12**, wherein:

the body portions of each of the leg members have a
10 circular cross section; and

the circular cross sectional size of one of the leg members at the top surface is equal to the circular cross sectional size of another of the leg members at the bottom
15 surface.

16. The modular leg kit of claim **15**, wherein the body portions are cylindrical.

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